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VIEWS, NEWS AND INTERVIEWS

Mr. H. R. Chamberlain, the London correspondent of the New York *Sun*, who went to Rennes, France, to report the Dreyfus trial, gives, in a recent letter, some interesting details of the work of the 300 newspaper men who were there from all parts of the world. He says, in part: "The problem of quick communication with the outside world was an ever-present difficulty from the first day of the trial until the last. There were available six telegraph and four telephone wires from Rennes to Paris, two wires to Brest, the landing place of the French Cable Company's lines to America, and one wire to Havre, where the Commercial company's cables touch. The best apparatus and most skillful operators in France were assembled at Rennes for the tremendous task of conveying the news of the trial to the four quarters of the world. Considering the facilities available, the result was probably the best accomplishment in telegraphy in this or any other country. On the first day more than 650,000 words were transmitted by telegraph alone. This quantity was exceeded on the day Labori was shot, and on other days it varied between the maximum and a minimum of 350,000 words. It would be unfair, perhaps, to criticise the quality of the work in view of its overwhelming quantity. An operator who sends at highest speed long messages in any of half a dozen languages which he does not understand can hardly be blamed if the despatches fail to arrive letter perfect at their destination. When it is considered, however, that nearly one-half the matter sent over the wires from Rennes was written in English, German, Italian, Russian, Spanish or Swedish, it must be admitted that the accomplishment of the Rennes telegraph corps was something stupendous."

William B. Bradbury, a San Francisco millionaire, spent twenty-four hours in jail last week for expectorating on the floor of a street car. Bradbury was convicted in the police court on May 13, 1897, of a violation of the ordinance which prohibits expectoration in public places. Bradbury added to his offense by spitting several times after the conductor had called his attention to the rules and profanely asking what the company proposed to do about it. As he had already been fined for a similar offense, he was sentenced to jail for twenty-four hours without the alternative of a fine. The millionaire has spent two years in appealing the case, but judgment was finally entered on September 1.

"Don't tell me anything about the advantages of a cable code. I know all about the code business, and it is a delusion and a snare."

The man looked angry and worried, says the New York *Tribune*, but was finally induced to relate his experience.

"It was like this," said the angry man. "When my wife went to Europe we agreed to use the P. D. Q. code, in order that we might correspond by wire at the lowest possible rate. There is hardly anything that one can't tell in a few words by the use of a code, and sentences of ten and fifteen words, which would cost two dollars and fifty cents or three dollars and seventy-five cents by the ordinary tariff, exclusive of address and signature, can be sent for twenty-five or fifty cents. The first message came to me on the day my wife landed at Queenstown, and, although it consisted of only three words, it told me that she had had an enjoyable trip, met a lot of nice people, and never missed a meal. I went among my friends and expatiated on the advantages of the code business, and now I feel like going to them to take back all I said, and this is the cause."

And he showed a cable message with the words "Nurry Chiraide."

"I hunted all through the book," he said. "I've studied it inside out and upside down, and can't find the words, and I don't know if the message means 'I am desperately ill and want you to come at once,' 'My money has been stolen; send me a fresh supply,' or 'I leave for Rome to-morrow,' or any other thing."

"But I got even on the code business. I sent a message in reply with these words, 'Amulet Amiel.'"

"And what does that mean?" asked the interested listener.

"That's the point. The words are not in our code book, nor in any other code book that I know of, and I sent them to give my wife a chance to exercise her imagination, so that she may be able to talk intelligently on the subject of codes, for I want no advantage in that direction."

The Ottawa, Ont., Electric Light Company has offered to sell out to the city for a little over $1,200,000.

FIG. 1.—INTERIOR OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY'S POWER-HOUSE.

INCREASED ELECTRIC POWER DEVELOPMENTS AT NIAGARA FALLS.

THE WORK OF ENLARGING THE PLANTS OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY AND THE ELECTROLYTIC INDUSTRIES AT THE FALLS.

The Niagara Falls Hydraulic Power & Manufacturing Company is making great strides in the development of the power made available by means of its surface canal that conducts a portion of the flow of the upper Niagara River through the city, a distance of about 4,400 feet, to the edge of the high bank of the lower river, where it plunges through penstocks and down to the turbines operating many generators. During the present year this company has directed its energies to the widening and deepening of the canal at several points, in order that the flow of water may be increased, thus affording an improved supply to the power-house referred to and to the various mills located on the canal basin. One notable improvement that has been made is the construction of a new bridge across the canal at Main street, which has made possible the widening of the canal from 70 to 100 feet at this point. Between the foundations of this bridge and the canal basin the waterway has been widened, so that now its banks stand far back of the former line, creating quite a bay in front of the hills on the edge of the bank. This part of the canal and the basin has also been deepened, and on days when the company's fleet of dredges, drill-boats, tugs, scows are all at work at this point the scene is one of great activity. In Fig. 2 the company's fleet is seen at work on the canal and basin below the Main street bridge, the main point of recent operations.

Down in the power-station, below the bank, a similar scene of activity is presented. There several new turbines are being installed as rapidly as possible, while new generators are on the ground ready to be erected. In

this station there are now in operation four turbines made by James Leffel & Company, of Springfield, Ohio, and one turbine made by a Philadelphia firm. Three of the turbines, made by James Leffel & Company, operate generators that supply the lower works of the Pittsburgh Reduction Company with current, the fourth operating two generators that supply the Niagara Gorge Railroad, the Lewiston & Youngstown road, and several motors. The other turbine operates a generator that supplies the National Electrolytic Company with current, and also an alternator connected to the incandescent system of the Buffalo & Niagara Falls Electric Light and Power Company. The new turbines that are being installed will operate generators to supply current to the extension of the aluminum works of the Pittsburgh Reduction Company, and turbines to be installed later will furnish power for operating other generators.

The turbine operating the alternator and the National Electrolytic Company's generator is shown in Fig. 1. These form the first set of machines installed in the second section of the Niagara Falls Hydraulic Power and Manufacturing Company's station. The turbine is of 2,500 horse-power. The new turbines now being installed will stand in the rear of this set of machines, and will receive their water supply from the same penstock. This penstock is the one last erected. It is 11½ feet in diameter, and stands out from the cliff in column form. The valves through which water is fed to the turbines are 60 inches in diameter; and there are five of these valves, thus allowing five turbines to be installed on the penstock, which practically will complete the installation in the second section of the station. In the new turbines slight changes have been made in the shape of the buckets.

Inasmuch as the output capacity of this new section of the power-station is practically leased, the Niagara Falls Hydraulic Power and Manufacturing Company has commenced excavating for the third section of the station, and, when this is done, it will complete the building according to the original plans. The new section will be 100 by 60 feet, making the total dimensions of the station 100 by 180 feet. Machines similar to those now in use in the station will, no doubt, be installed in the new section.

The various industries on the lands of the Niagara Falls Hydraulic Power and Manufacturing Company using electric power are in a very progressive state, and the majority of them are extending their plants and soon will be calling for more power. This is true of the National Electrolytic Company and the Pittsburgh Reduction Company, while the Acker Process Company's plant will demand a big supply of power before many months have passed. This last-mentioned plant is located on the lands of the Niagara Falls Hydraulic Power and Manufacturing Company and faces Third street. The new buildings are of brick and iron. The machine equipment of the factory has commenced to arrive, and is being installed as rapidly as possible. Other buildings will be erected, the site for a larger building than any yet constructed being now cleared. This industry promises to slightly revolutionize the caustic soda and bleaching powder markets, as the process is said to be exceedingly efficient.

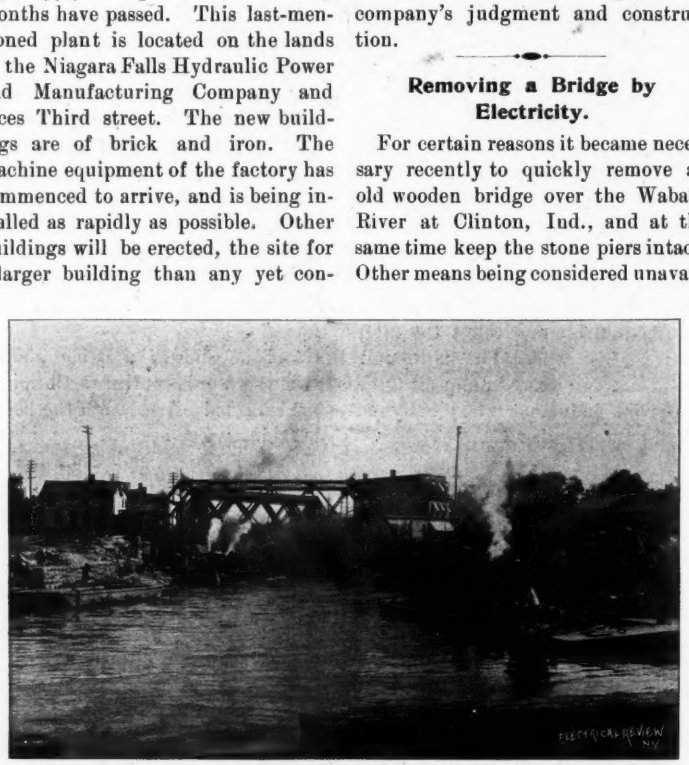


FIG. 2.—FLEET OF DRILL AND DREDGE BOATS AT WORK DEEPENING AND ENLARGING THE NIAGARA FALLS POWER CANAL.

The National Electrolytic Company manufacture chlorate of potash, and several times since the plant started it has been enlarged. Now an addition that will more than double the capacity of the plant has been commenced.

The Pittsburgh Reduction Company has been working all Summer enlarging its lower works. The main building has been extended out half way over the canal, connecting the canal basin with the forebay, and this increases the factory room considerably, while a new building has been erected for storage purposes. When the new pot-room of this plant is put in operation the output of aluminum will be materially increased.

With the completion of the power-house, it is probable that the Niagara Falls Hydraulic Power and Manufacturing Company will take into consideration the erection of another station, and this is likely to be located a little further down stream, possibly below the Central flouring mill. There is a probability that this new station will be an alternating-current station, but the demands of consumers will no doubt regulate the company's judgment and construction.

Removing a Bridge by Electricity.

For certain reasons it became necessary recently to quickly remove an old wooden bridge over the Wabash River at Clinton, Ind., and at the same time keep the stone piers intact. Other means being considered unavailable, a plan suggested by H. N. Mills, an electrician, was adopted with success. Each span of the bridge was composed of nine chords, each consisting of three timbers. Therefore if these twenty-seven sills were cut simultaneously the span would drop between the piers to the river beneath. This was what was actually done, the cutting being accomplished by burning through the wood by loops of iron resistance wire made red-hot by the passage of an electric current and weighted down by sash weights. The timbers were of yellow poplar and nine inches square. Each one was burned simultaneously in two places. Thus the mass of timbers dropped well inside the piers without injuring them. It took one hour and forty minutes to wreck each span. The current was first turned on about five o'clock in the morning on the day of the wrecking, and at two o'clock in the afternoon the last span crashed to the river bed.

The Woods Motor Vehicle Company, of East Orange, N. J., with a capital of $10,000,000, has been licensed to do business in Illinois with a capital of $65,000.

The American Street Railway Association.

The eighteenth annual convention of the American Street Railway Association is to be held at Chicago, beginning October 17, and, in addition to an extensive programme of papers and discussions, a fine exhibition has been planned and promises to be very interesting and complete. About one hundred exhibitors have taken space.

The headquarters of the convention will be at the Auditorium Hotel, and the exhibition will be held at Tattersall's, on Sixteenth street, a few blocks away.

Arrangements are being made for the transportation of the delegates and their friends from the East, the majority leaving on Sunday, October 15. The president of the association, Mr. C. S. Sergeant, of Boston, with others from his city, will unite at Albany with the party leaving here over the New York Central Railroad.

The Pennsylvania Railroad and the Erie Railroad are also offering special facilities for the delegates who desire to go over their lines. Mr. M. C. Roach, 413 Broadway, will look after the accommodations for passengers over the New York Central Railroad; Mr. Samuel Carpenter, 1196 Broadway, will take care of the interests of passengers *via* the Pennsylvania Railroad, and Mr. James Buckley, 401 Broadway, will look after the accommodations for passengers over the Erie Railroad.

Among the leading exhibitors that have taken space are the Westinghouse Electric and Manufacturing Company, General Electric Company, Safety Insulated Wire and Cable Company, Central Electric Company, Gold Car Heating Company, Standard Paint Company, Garton-Daniels Electric Company, American Steel & Wire Company, Standard Underground Cable Company, the Okonite Company, Sterling Supply and Manufacturing Company, Morris Electric Company, New Haven Car Register Company, Joseph Dixon Crucible Company and Siegrist Lubricator Company.

The reduced fare ticket of one and one-third for the round trip (certificate plan) will be good leaving New York, Friday, October 13, and for the return trip leaving Chicago October 22.

What Makes the Wheels Go Round.

"What makes it go?" asked one of the curious bystanders.

"Money," replied the owner of the automobile, who had become tired of answering that question.

"Same as a mare." — *Chicago Tribune.*

ELECTRICAL DECORATIONS IN HONOR OF ADMIRAL DEWEY.

THE MAGNIFICENT ELECTRICAL ILLUMINATION OF NEW YORK CITY AND HARBOR, THE BROOKLYN BRIDGE, AND PUBLIC AND PRIVATE BUILDINGS UPON THE ADMIRAL'S RETURN.

There was one feature of the Dewey fêtes in New York city last week which was unique, and which would have been impossible a few years ago—the marvelous electrical illumination of the city and its surrounding waters.

The municipality's official electrical illumination begun and ended with the great sign and searchlights on the Brooklyn Bridge. The electric sign was the largest ever constructed, containing about 8,000 16-candle-power incandescent lamps, arranged to spell the words "Welcome Dewey." The letters were 36 feet high, and the sign extended 400 feet along the central span of the great Bridge. It was constructed by Mr. W. H. Boyes, of Brooklyn, who evolved an ingenious method for making the great electric letters. Along the outer panel of the stiffening truss at the middle of the Bridge a number of poles about forty feet high were securely lashed. Upon these, as a foundation, was strung a network of steel and copper wires, the latter forming the outlines of the great letters. Across these were strung the lamps in series of five. Current, at 550 volts, was taken from the third-rail system of the main Bridge tracks.

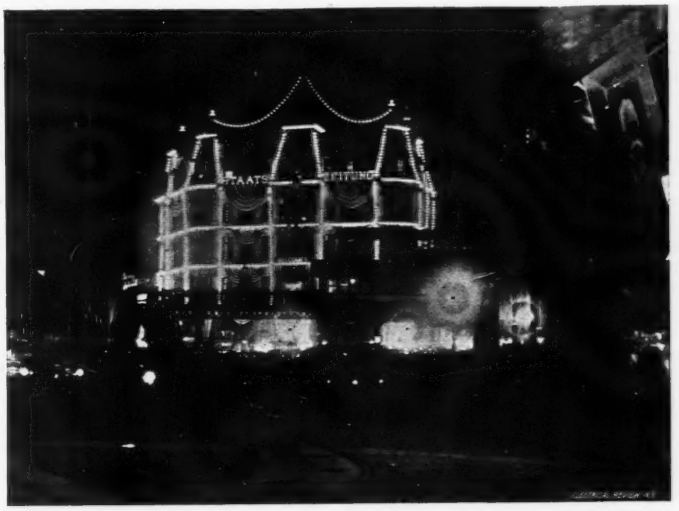
The remarkable feature of the sign was that unfinished lamps were used. They were not provided with bases, but consisted simply of the glass bulb with its short leading-out wires. To these were attached short pieces of small gauge bare copper wire with which the lamps were connected together. The cavity in the butt of each lamp was stopped with a small cork, and the whole dabbed with shellac. Naturally, the strings of five lamps swung in the wind and jiggled up and down with the vibrations of the great Bridge, so that many circuits were broken and refused to light up when the individual letters were tested. Consequently it was found necessary to stay the lamps with twine, which was knitted about them in such a way as to hold them steady. The illumination of the sign was very successful, its appearance being well shown in one of the accompanying illustrations reproduced from a photograph by Mr. W. Moehring, of New York city.

On the tops of the bridge towers were placed thirty inch searchlights from the New York Navy Yard, operated by men of the Brooklyn battalion of the Naval Militia. To reach their airy perches these men had to climb up rope ladders outside the towers, which are 278 feet high.

The Pennsylvania Railroad erected another magnificent sign of welcome on the end of its enormous train shed in Jersey City. Upon the great arc of the east gable, facing across the Hudson River towards Manhattan, appeared, in letters about fifteen feet high, the legend "Welcome to Admiral Dewey." On the pier-heads of the ferry slips in front of the stations were large keystones, the symbol of the Pennsylvania, in electric lamps, while all of the large ferryboats were elaborately decorated with lines of lamps—several hundred lights on each.

Searchlights abounded. On the tops of a dozen or more of the high buildings along the water-front, in the lower part of Manhattan, on the heights of Brooklyn, they were planted, and, especially on Friday night when the great exhibition of fireworks was in progress, their beams weaving across the sky were exceedingly beautiful.

Many elaborate decorations of private buildings were carried out. The high tower-like American Surety Company's building, in lower Broadway, was lit from top to bottom with vertical rows of lamps and its gilded cornice was picked out with multi-colored lamps. From a distance the white building glowed like a gigantic candle. The New York Life Insurance Company's building was elaborately decorated with lamps, the globe on its tower, some three hundred feet above the sidewalk, being temporarily turned into a ball of fire. Among other buildings with elaborate decorations were those of the New York *World* and *Staats Zeitung*, which appears in one of the accompanying illustrations.



ELECTRICAL DECORATIONS IN HONOR OF DEWEY.—"STAATS ZEITUNG" BUILDING, LOOKING UP PARK ROW, NEW YORK.

THE BROOKLYN BRIDGE AT NIGHT, SHOWING ELECTRIC SIGN, ARC LIGHTS AND SEARCHLIGHT.

The North Atlantic Squadron, headed by Admiral Dewey's flagship, Olympia, lay in the Hudson River in a column extending south from One Hundred and Tenth street to Sixtieth street. On Friday and Saturday evenings the war vessels were brilliantly illuminated with electric lights and made a fine show for observers along Riverside Drive or afloat.

Admiral Dewey and all the officers of his flagship were greatly pleased. A great deal of business was transacted, and Admiral Sampson, who was visiting Admiral Dewey, held a conversation with Baltimore from the flagship Olympia. When the ship came out from Tompkinsville to join the naval parade the cable was dropped with a mooring buoy to mark it.

Admiral Dewey's Ship Had a Telephone.

The New York & New Jersey Telephone Company installed last week a set of long-distance telephone apparatus aboard Admiral Dewey's flagship Olympia. Two copper-sheathed cables were laid between the ship and the mainland at Tompkinsville, Staten Island.

The telephone was installed through the courtesy of General Manager W. D. Sargent and General Superintendent J. C. Reilly, of the New York & New Jersey Telephone Company. The Safety Insulated Wire and Cable Company, of New York city, supplied the cable.

The cable was laid after dark, with the searchlights of the fleet playing on the workmen and the boat in which they brought up the cable. The cable itself was made fast to the anchor-chain of the Olympia, and sufficient slack was allowed so that the ship could swing with the tide.

This is believed by naval officers to be the first time in the history of the service that a warship has been connected by submarine cable with the shore in this way. In the harbor of Honolulu telephone connection between vessels and the shore may be had by anchoring the vessel both at bow and stern and connecting up with a permanent telephone cable. It will also be remembered that when the steamship St. Paul went ashore on the New Jersey coast a few years ago, telephonic communication was maintained by an aerial line which was carried from the mast-head of the ship to the shore.

SCIENCE BREVITIES.

Central Station on Wheels—The Eastern Railway Company, of France, is utilizing what *L'Industrie Electrique* calls a central station on wheels for repairing the Torcenay tunnel. It is mounted on a railway truck, and includes a petroleum engine driving a dynamo, which furnishes current both for propelling the truck by means of a motor and for lighting the works in the tunnel. This little central station suffices for four to six arc lamps or 20 to 40 incandescent lamps, and it has been found of great service in tunnels and for night work. Our contemporary also states that in Germany trials are being made with an ambulance carriage built on similar lines. It is provided with a five-horse-power petroleum engine, with sufficient fuel to run 15 hours, driving a 63-volt 40-ampere dynamo, and is furnished with a powerful projector.

Aluminum in India—Prof. Chatterton, of the College of Engineering and the School of Arts, Madras, writes to the *Madras Mail*, stating that the manufacture of domestic utensils, and the like, of aluminum, is making a great stride in India. The work was originally started at the School of Arts, but there are now several other centers of manufacture, and the more general adoption of the metal is being hastened by the prevailing high prices of copper and tin. A large order for cooking vessels for the 28th Madras Infantry has recently been filled at the school. These vessels have almost of necessity to be made by hand, since each native regiment has its own patterns. The production of a suitable water bottle is, however, a difficulty, as the flat pattern is not easily made in aluminum since soldering can not be used; while a cylindrical pattern can not be conveniently carried. Aluminum has also recently been used as a bearing metal for shafting in the Madras College of Engineering and has proved satisfactory.

Vacuum Discharges and Ohm's Law—Signor A. Righi has observed a curious and interesting phenomenon in a circuit containing a vacuum tube, of which the *Electrician* abstracts a description from an Italian contemporary. The circuit contains a battery of small accumulators, a vacuum tube with unequal electrodes (such as a point and a disk or a knob), a sensitive galvanometer, and a high resistance, usually of distilled water. The tube lights up in an apparently continuous manner, and the galvanometer indicates a small continuous current. Under these conditions it is only necessary to change the place at which the resistance is inserted in order to bring about a change, not only in the luminosity of the tube, but also in the intensity of the current. This is contrary to Ohm's law, and indicates that if that law applies to gases, the discharge is not continuous. In one case quoted, the tube contained nitrogen of 0.3mm. pressure, there were 282 accumulators in circuit, and the water resistance amounted to 30 million ohms. When the resistance was inserted between the tube and the positive pole of the battery, the current was 5.48 microamperes, and when between the tube and the negative pole it was 0.4 microampere. A great variety of gases and electrodes showed the same phenomenon, which deserves to be more closely studied.

Chemical Composition and Electrical Properties of Glass—The following abstract of a paper, read by Messrs. A. Gray and J. J. Dobbie before the Royal Society, appears in the (London) *Electrical Engineer*. The authors, in conjunction with Mr. T. Gray, previously established the general result that the electrical conductivity of lead glass increases with the amount of soda present, and decreases as the percentage of lead oxide rises. In the present investigation, the specific resistance and specific inductive capacity of several glasses, made specially for the investigation, have been determined. The two lead glasses examined were almost free from soda, and had a higher percentage of lead oxide (43 per cent and 47 per cent) than any previously used; they both had an extremely high specific resistance—too high to be measured. Another glass, described as barium aluminum borosilicate, had the very high specific resistance (ohms) of above 59.000×10^{10} at all temperatures up to 140 degrees, thus behaving more like a lead glass than a lime glass. This glass shows scarcely any trace of dielectric polarization. The effect that soda has in increasing the conductivity is shown in the case of a zinc-soda "Jena glass," the specific resistance of which was 596.5×10^{10} at 43 degrees, and 0.200×10^{10} at 140 degrees.

Pressure within the Electric Spark—By the aid of his 11,000-cell silver chloride battery Warren de la Rue observed that a stream of sparks passing through a partial vacuum produced a sudden but entirely temporary increase of the pressure. That this increase of pressure is not due to the heat of the spark is proved by its subsidence immediately on the cessation of the spark, and by its magnitude, which may amount to 16mm. in a pressure of 56mm. E. Haschek and H. Mache have studied this interesting phenomenon further, and arrived at a pretty close estimate of the pressure within the spark itself, which they describe in *Wiedemann's Annalen*. Having obtained an idea of the actual dimensions of the spark by photography, they measured the increase of pressure per unit surface of the vacuum tube by a specially-constructed manometer. That being done, it was easy to arrive at the total increase of pressure, and by reducing that to the surface of the spark to obtain the pressure within the spark itself. That pressure was found to increase generally with the energy, the pressure of the gas, and the sparking distance. It was also higher in sparks playing between carbon electrodes than in those of iron, zinc or other metals. It is attributable to the particles projected from the electrodes, which, according to Schuster, may attain velocities of 2,000m. per second.

Victorium—In his presidential address before the British Association last September, Sir William Crookes announced the discovery of a new element to which he proposed to give the provisional name of Monium. Since that date he has completed his investigations, and laid a full account of them before the Royal Society. The new element, which has been renamed Victorium, is of a pale brown color, easily soluble in acids. It is less basic than yttria, and more basic than most of the earths of the terbia group. In chemical properties it differs in many respects from yttria, but, speaking generally, it occupies a mid-position between that element and terbium. On the assumption that the oxide has the composition $Ve_2 O_3$, the atomic weight of Victorium is apparently not far from 117. The photograph of the phosphorescent spectrum of the oxide, Victoria, shows certain definite lines that have not hitherto been associated with any other element. The method by which this latest discovery has been made affords an excellent example of the possibilities of modern research, especially in the hands of a man who commands the resources of more than one branch of science, and is able to employ the highest powers of each alternately as need arises. In addition to the chemical operations requiring the highest judgment and much manipulative skill, which were employed to isolate the substance, its identification and investigation were only possible by the application of physical methods still more complicated in their nature. The almost pure element had to be enclosed in a vacuous bulb, and submitted to molecular bombardment from the negative pole of an induction coil in the manner now familiar by the frequent exhibition of the X-ray bulb. The phosphorescent glow thus obtained was examined through a specially-designed spectroscope of extreme power and precision, whose results were recorded by a photographic plate, the rays of special interest being in the ultra-violet part of the spectrum, and therefore invisible to the naked eye.

THE FORERUNNERS OF THE NERNST LAMP.*

BY ETIENNE DE FODOR.

(*Concluded from page 195*)

The only glow-lamps spoken of about this time were the complicated carbon-pencil lamps (incandescent arc lamps) of Reynier, Werdermann, etc. The partnership entered into with Gramme, the Société Générale d'Electricité, also acted as a deterrent to further work on the kaolin lamp, as the company considered it unprofitable. So it happened that the illumination of dwellings was left out of consideration. Rumors, it is true, had already been circulated regarding the then unknown Edison lamp, and had even caused a panic in gas stocks, but soon again came the reports that Edison's investigations had ended in failure, and, on December 6, 1878, Sir William Siemens declared, before the London Society of Arts, that he laid no great weight on "the partition of the electric light, now causing so much talk, and that it can not be achieved with any degree of economy."

The dirge of the kaolin lamp was, however, sung by Fontaine, the director of the company controlling Jablochkoff's patents, when he wrote in the *Revue Industrielle* for 1878: "We consider an economical partition of the electric light improbable. It is beyond argument, that as the electric light is divided and the power of single units is decreased, so will the cost of labor and operation be increased." This, coming from one of Jablochkoff's own associates, directly contradicted him.

Jablochkoff's answer to the above and to the many other queries concerning this matter is to be found in *Correspondence Scientifique* of October 29, 1878: "I have already accomplished a partition of electric light, using but one source of electricity, and have shown it to be analogous to gas or water in this division. Further, with a single source of current, I am of the opinion that electric lights of various intensities can be maintained, these ranging from the tiniest night-light to the largest lamp. Regarding illumination, I take the stand that the largest lamps can be regulated so as to give as much light as required, somewhat after the manner of gas."

Jablochkoff again made an attempt to bring his lamp into publicity in 1879, at an exhibition given by the

*Translated and abridged from *Elektrotechnischer Anzeiger*.

Society of Telegraph Engineers, of London, where the kaolin lamp was exhibited in operation.

During all this time of vain strivings to bring his lamp to a practical footing, and while he was being discouraged by his associates and the profession in general, Edison, in America, was working with iron energy and unshakable fixedness of opinion, that the electric light could be evolved into a means for interior illumination. He had seen the efforts of Wallace, also an American, to produce an arc lamp which should give a light of long duration, and which is still remembered as the Wallace–Farmer lamp. Edison said to the inventor: "Wallace, I think I can beat you making electric light; you are on the wrong track," and, going home to Menlo Park, went to work on a useful glow-lamp. Edison well knew of the work in this field that had been done before him, and has never laid claim to the title of the discoverer of the glow lamp. He started, however, with but the one idea—that by means of the incandescence of a very refractory material was the division of the electric light to be accomplished in practice. This idea is the foundation of all his incandescent lamp patents.

Up to this time little was known of what is now electrical engineering. The art of generating, measuring and utilizing electrical energy was indeed in its infancy, and various clumsy devices, such as Jablochkoff's induction coils to produce high tension, were in use to meet special conditions for which dynamos had not been designed. Edison saw, at the beginning of his experiments, the necessity of accurately measuring the energy used in his lamps, and the instruments, made by him specially for the purpose, were probably the true means of his arriving at his unqualified success.

He began his experiments at the same point as Jablochkoff; namely, with refractory materials, because these combined the two great desiderata sought after—the giving off of bright light with small consumption of active material. He first used high-tension currents (what was then understood as high-tension), and used the induction coils of Jablochkoff to produce them. After trying various arrangements of these coils, he gave them up for a parallel system of current supply and alternating current, each lamp having its own transformer. This whole arrangement was, however, nothing new in America.

Edison instituted a series of researches with various refractory bodies, aiming to secure a white, pleasant light. He tried them in shapes of plates, rods, wires, etc., and mixed in various metals, salts and earths. To make the incandescing portion a better conductor he added lampblack, coal-dust, syrup, etc., and attained notworthy illuminating effects. He soon saw that either a very high voltage had to be employed or the incandescing portions had to be heated before they would conduct current and light up. Investigations were now started by him to find out what voltage could safely be used in dwelling places and he fixed on from 100 to 110 volts. This was not enough to bring refractory bodies to a glow, so he turned his attention to automatic devices by means of which the warming of these bodies could be accomplished. The best of these was a platinum spiral, put in the circuit in parallel with the incandescing substance. This spiral was heated up by the current when first turned on, and as it was wound about, or close to, the refractory material heated it in turn until it conducted and slowly came up to a white heat, when a small spring served to open the circuit for the spiral.

Though this arrangement worked fairly well, the refractory material was short-lived and his endeavors to enclose it in a glass globe were also unsuccessful, as the latter soon became covered with an opaque coating from the disaggregation of the material. "This is not the right way," at last, said Edison, and began work on a different class of lamp, using a platinum wire After many efforts to get a platinum wire in which there were no microscopic fissures or uneven spots he was fairly successful, but still not satisfied. His lamp did not give him a perfectly white light, so he sought to heighten the luminosity by other means. He wrapped a platinum spiral about a clay cylinder and covered the wire with a thin layer of zirconia, which was heated to incandescence. This arrangement was also not durable, and Edison did not try any longer to employ refractory bodies of this class in his lamp. Some months later he brought out his lamp with a carbon filament and the problem of the "partition of the electric light" was solved.

The glowing reception given to the carbon-filament incandescent lamp from all quarters deeply impressed Jablochkoff, who had considered it his greatest achievement to have done away with carbon in the electric lamp. The artificial carbon rods then manufactured were so poor that retort-carbon was still given the preference, and for this reason the glow-lamp of Lodigine and Kosloff was a failure, for the thin carbon sticks prescribed by the inventors could not be made durable; also in other lamps, *i. e.*, those of Reynier, Werdermann, etc., employing these same carbon sticks, the brittleness and poor quality of the material was an almost unsurmountable difficulty. A vacuum lamp with incandescent carbon was no novelty; King, in 1845, patented such a one and was followed by Greene and Staite in 1848, Roberts in 1852 and Konn in 1872. But none of these were successful, as nothing but retort-carbon was considered; Jablochkoff was therefore proud of his kaolin lamp, for he believed he had eliminated carbon; Edison then brought forward his carbon filament, and with this simple device, not before thought of, wrecked Jablochkoff's entire reputation. The latter, however, would not believe in the success of the Edison lamp. One notes 1881 as the first year in which an electrical exhibition was to be held, and yet no authentic information had been received from America, but by this time Swan, in England, had succeeded in making good carbon-filament lamps which had been successfully tested, and Lane–Fox had also taken out his patents. Jablochkoff, who was then busying himself with his alternators, heard with dismay of the great progress made by the carbon-filament lamp, for just at the time when he was so near the commercial success of his system he became aware that his fame had vanished.

On August 1, 1881, the Paris Electrical Exhibition was to open, in which Edison, Swan and Maxim were to celebrate their triumphs. The "Soleil" lamp, constructed by Clerc and Bureau, in which a piece of marble is kept white hot by the voltaic arc, also now made its appearance, and was but a Jablochhoff kaolin lamp enlarged The trial of "candles" in that year's salon exhibit had been a failure, and the inventor was the target of innumerable requests to perfect his candles and reduce his kaolin lamp to a practical state. At the exhibition now opened in the Palace of Industries, the Jablochkoff apparatus and lamps were shown, but the French papers took not the slightest notice of his kaolin lamp, and the only illustrated article concerning it, is found in an English paper, which speaks of its light as yellow, of from 20 to 30 candles, and the length of the glowing band as being about 1½ inches. "The porcelain plate is slowly used up, but can be renewed for small cost; the energy required is considerable, which is a fault common to all glow-lamps."

This was the last time that the kaolin lamp came before the public The proper time to have introduced it into practice had slipped by.

The first electrical exhibition had ended, and the carbon-filament lamp reigned triumphant. It soon replaced the "candle," and its inventor was soon a forgotten man. Disappointed and broken in body, spirit and finances, he and his kaolin lamp were both lost sight of.

The carbon-filament lamp was, however, not destined to have an entirely even existence, due to the amount of energy per candle-power which it consumes, and which seems to be limited to 2½ watts per candle-power, with fairly long life. Before many years had passed, inventors were already hard at work to find another "light of the future."

Instead of carbon another substance was to be found capable of standing a high temperature (that of white heat) without change of condition. The Drummond lime-light and the magnesium lamp give us that type of light which we are now endeavoring to produce by electricity in an economical manner. The Nernst lamp is one trial at the solution of this problem, and, after a pause of twenty years, the researches of Jablochkoff will be continued.

What will be the success of the Nernst lamp is not to be discussed here, and it would scarcely be fair to Jablochkoff's work to predict immediate, practical results for Nernst. The incandescent lamp of Edison and Swan was nothing new, it having existed since 1841; it took, however, the tireless energy of Edison to bring it to final perfection. If Jablochkoff had had the endurance and ingenuity of Edison, the kaolin lamp would have played an important role in the last twenty-two years. Nernst, in taking up his work, understands that the profession is in the same condition of mind as regards his discoveries as when it awaited the advent of the Edison lamp, since, even though not entirely original, his work has excited universal interest.

A close analogue with the early type of Edison lamp is found in the automatically cutout platinum spiral used for heating in the Nernst lamp. Edison found that practice would not easily accept such a complicated arrangement. Whether the public has changed its view and will look on this type of Nernst lamp with more favor, the future will show.

Nernst has probably found further analogies with Edison's and Jablochkoff's investigations, but it is possible that he did not know of their work, for some of the pioneers in electrotechnics have forgotten the events of the early days, of which the young scientists, such as Nernst, have no knowledge. This speedy forgetting was markedly shown at the reading by Swinburne, before the London Society of Arts, of a paper on the Nernst lamp. Of the entire scientific audience, only Professor Swinton remembered the kaolin lamps of Jablochkoff, while the lecturer did not remember such a lamp.

After a complete study of the events of the past, a great many patent applications may be seen to be worthless; those of the past twenty years only show that an incandescing material of earth and salts is no longer patentable, and when it is taken into consideration that, in the exhaustive investigations of Edison and Jablochkoff, no substance exists which did not enter into some one of the combinations experimented with, a mixture of zirconium with other oxides will be seen to be probably unpatentable.

In conclusion, there may be pointed out the following result deduced from the experiences of the past: That good ideas are not always rewarded with success, and that unceasing energy and iron endurance are needed to carry out the best of them. If these requirements be present, the Nernst lamp will have that success which is wished it by all.

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MUNICIPAL VERSUS PRIVATE OWNERSHIP.

In the last issue of the ELECTRICAL REVIEW it was stated that the League of American Municipalities had accepted the proposition of the National Electric Light Association to join with that body in an impartial investigation of the municipal and private electric lighting plants of the United States, in order to settle the many questions in dispute concerning the relative advantages of the two varieties of ownership. This question is such a broad one that it is to be hoped that no specification will confine the scope of the inquiries or tie the hands of the investigators. The economics of central station management and the supply of electric light can not be fully understood by a mere inquiry into the costs of fuel, labor, materials, etc. For the purpose of such an inquiry, the municipal plant should be put upon absolutely the same plane as the private plant; it should be charged with every proper item of depreciation, interest, sinking fund, etc., and for once the accounts of such an installation should be made public in their entirety. It has been alleged over and over again that wherever in the United States a plant owned by a municipality has made a more than ordinary showing, it has been because of the suppression of certain items of expense in the bookkeeping of the plant. Municipalities are prone to forget, in making out the accounts of their own public service institutions, to charge for relinquished taxes, for interest and depreciation, for sinking funds and emergency accounts, and very often for such items as water when the city itself supplies this. What is needed to make the proposed investigation final and satisfactory is a most thorough inquiry into all these matters. The operation of the plants must be contrasted from an identical point of view; there must be no jugglery of figures tending to confuse and obscure the actual facts. It is pretty well known what the cost of producing electric light, under definite conditions and with private ownership of the installation, amounts to; just what it costs a municipality to do the same thing has never yet been set forth in such a final and authoritative way as to command universal belief. It is, therefore, urgently to be hoped that every item will be considered in the proposed investigation, that the investigators shall waive the letter of the resolution under which they act and conduct their work rather in accordance with its spirit. If this is done we may hope to have some final word on the vexed and bitterly disputed question of what it costs a city to make its own light.

On another page is a description of the telephone installation lately put aboard the United States cruiser Olympia while she lay at anchor off Tompkinsville in New York Harbor. It is believed that this is the first time that a ship riding at single anchor has had telephone connection with a submarine cable. In the harbor of Honolulu ships on the naval anchorage are anchored fore and aft, so that they do not swing with the current and tide. Telephone connections are made with them through a submarine cable, but it is easy to see that the problem is quite different when the ship is attached to the ground by only one anchor, and is free to swing as the winds and currents influence it. In this same connection why should not every naval station and navy yard be provided with permanent connections so that ships when docked may be put in communication with the telephone network of the neighborhood? The convenience of such an arrangement in the New York Navy Yard, for example, would be enormous, and its value out of all proportion to its small cost.

The electrical illuminations and decorations which were an imposing feature of the Dewey celebrations in New York city last week were probably the most elaborate of their sort that have ever been shown. The ease with which electric light lends itself to the purposes of the decorator is probably responsible for the great popularity of this most beautiful variety of illumination. On many of the high buildings in lower New York the architectural lines were picked out by rows of incandescent lamps, and a very large number of searchlights was installed about New York and Brooklyn. It would be interesting to know just how many lights were used for decorative purposes, and what the power required to operate them amounted to. One sign, that on the Brooklyn Bridge, reading "Welcome Dewey" in gigantic letters, contained 8,000 lamps, and must have required over 600 horsepower for its operation.

What a holding up of the hands in horror there would have been ten years ago if anybody had suggested electric motors as the prime movers of a powder mill! Yet the art of constructing these machines has advanced so far that the induction motor is to day considered the safest power machine for such uses. The description of the new powder factory of the United States Navy Department published last week is of interest in showing the feeling of safety that has been engendered by the perfection of the electrical transmission and distribution of power. The induction motor has been said to be "as simple as a grindstone." Likewise it is as sparkless as a waterwheel, and in a dangerous place like a powder factory, as safe as a block of ice.

On some of its minor cross-town lines the Metropolitan Street Railway Company, of New York, is operating compressed-air cars. An indignant resident of one of these streets recently wrote to a newspaper complaining that the puffing of the cars disturbed his slumbers and that, as they were practically locomotives, only working under a much higher pressure than the ordinary locomotive, they made a proportionately larger amount of noise. He was right. They do. As a car starts it puffs viciously and energetically, and the separate puffs soon merge into a continuous roar. It is strange how long it takes to demonstrate that compressed air is not a suitable agency for traction work. It requires no prophecy to foresee the final retirement of these noisy cars from New York streets.

An Interview With Signor Marconi.

On the occasion of the races between Sir Thomas Lipton's yacht Shamrock and the American cup defender Columbia, which began October 3, an effort will be made by Mr. G. Marconi to report the various phases of the races for the benefit of the New York *Herald*. The new steamship Ponce, of 3,500 tons, will be used as the sending station. One of the masts of this vessel has been extended by a spar lashed upon it, so that the total height of the vertical sending circuit will be 140 feet above the water. There will be at least two receiving stations. One is to be on the mainland at the Highlands of Navesink on the New Jersey coast. This will consist of the usual high mast, and will be directly connected to the land wires of the various telegraph companies, and from it reports will be telegraphed as rapidly as possible to all parts of the United States. A second receiving station will be installed on board of the cableship Mackay–Bennett, which will be anchored at a point near Scotland Lightship, which is stationed a few miles east of Sandy Hook. At this point there is a submarine cable connecting New York and Ireland, and this cable will be lifted up to the deck of the Mackay–Bennett and cut, and the cable-sending instruments which will be used to transmit the wave messages received will be cut in on the cable so that newspapers in New York and London will receive identical news simultaneously.

Mr. Marconi, accompanied by a staff of assistants, arrived in New York a few days ago, and since has been busily engaged in making the installations aboard the Ponce and at the receiving stations.

To a representative of the ELECTRICAL REVIEW Mr. Marconi has given some interesting descriptions of his methods of operations. Replying to a question as to the nature of the electric waves employed in his system of telegraphy, he said that perhaps the fairest answer was that he did not know. It was evident, he said, after his experiments in connection with the recent British naval manœuvres, where signals had been exchanged at a distance of 66 nautical miles, that they were either sent through a vast dome of seawater (the curvature of the earth in this distance amounting to several hundred feet), or else they were transmitted through the atmosphere and curved around.

"As sea-water is a good conducting medium, so far as its effect on electric waves is concerned, it may be looked upon almost as a solid," said Mr. Marconi. "I am compelled to believe that it is not the Hertz waves traveling in right lines which are the agencies that effect wireless telegraphy in my system. I have found the vertical circuit to be absolutely essential to success. Another point which experience has fully demonstrated to me is that the sending instrument should be relatively very powerful and the receiving instrument relatively sensitive. The coherers I am using are very small; in fact, they contain only two or three filings. This is somewhat analogous to the experience that telephone companies have acquired, as they find that a weak receiver in conjunction with a powerful transmitter is much less affected by extraneous currents and noises than when a sensitive receiving instrument is used."

Replying to an inquiry about the reported "tuning" of the instruments employed in the cross-channel experiment between Dover and Boulogne-sur-Mer, Mr. Marconi said: "We have not perhaps actually achieved syntony, but we have found it possible in the three stations to telegraph from either to either of the other two without affecting the third. A careful balance is necessary between the height and capacity of transmitting and receiving lines. In the Dover experiments I used a capacity of about 0.007 microfarad. The masts employed were about 140 feet high." When asked whether he believed it would be possible to use this system for communication across the Atlantic, Mr. Marconi smiled in a deprecating way and said that certainly there seemed reasonable ground to hope for some such development, but that it was yet too early to do more than hope—certainly too soon to prophesy.

After the reporting of the yacht races, it is understood that Mr. Marconi will give a number of demonstrations of his system to officers of the United States Army Signal Corps, and that he will spend some time in Washington for this purpose. It is also understood that efforts are being made to form an American company for the exploitation of this system of communication.

The Allentown Electric Light & Power Company has been awarded the contract to light the streets of Allentown, Pa., for one year, at $100 for each arc light and $18 for each incandescent lamp.

REPORTING THE INTERNATIONAL YACHT RACES BY WIRELESS TELEGRAPHY.

SUCCESS OF THE MARCONI DEMONSTRATION.

On Tuesday, October 3, the first of the series of yacht races was held, and a representative of the ELECTRICAL REVIEW accompanied the corps of wireless telegraphers aboard the steamship Ponce which followed the racers. The foremast of this ship was lengthened by a spar lashed to it so that its highest point, to which was attached the upper end of the vertical signal wire, was 140 feet above the water. The apparatus aboard consisted of an induction coil about 12 inches long, having an ordinary hammer interrupter, some thirty or more very large cells of dry battery, a key in the primary circuit of the coil, and the receiving mechanism. The instruments were installed in the chart-house of the ship, a room about 8 by 12 feet, just abaft the pilot-house on the hurricane deck. The vertical circuit consisted of a bare No. 10 copper wire hanging from an insulator on the masthead and running through a section of ordinary rubber hose where it entered the door of the chart-house. The spark employed was about ½-inch long. The terminals of the coil, brass balls about an inch in diameter, were respectively connected to the vertical circuit described above and to the hull of the ship. When signals were to be received the sending apparatus was disconnected and the receiving coherer and its Morse recorder were connected. The instruments worked with great perfection, more than 2,000 words of bulletins of the race having been sent without repetition or misunderstanding.

In the chart-house of the Commercial Cable Company's cable ship Mackay–Bennett, which was anchored near the Sandy Hook lightship, a set of Marconi instruments was installed in charge of Mr. T. Bowden, of London. During the yacht race 60 bulletins were received from the steamship Ponce, all of which were acknowledged. Forty-six messages were received without a break at the rate of 15 to 16 words per minute. The one break was due to a mistake of the sending operator and was quickly corrected.

The longest distance over which transmission was accomplished was 15 miles, a bulletin being received just as the yachts turned the further stake boat. The performance was a complete success, and the many officials of the Commercial Cable Company and the Postal Telegraph–Cable Company who were present warmly expressed their appreciation. Mr. Charles Cuttriss, chief electrician of the Commercial Cable Company, said to a representative of the ELECTRICAL REVIEW who was present that the demonstration was satisfactory to him, but it reminded him of a "ghost talking."

Dynamo and Motor Manufacturers Hold a Meeting.

At the invitation of the Cutler–Hammer Manufacturing Company, of Chicago, a meeting of representatives of the dynamo and motor manufacturers of this country was held at the Grand Pacific Hotel on the evening of September 19. The gentlemen present were entertained at dinner by the Cutler–Hammer Manufacturing Company, and afterwards adjourned to another room where business matters of general interest were discussed.

Mr. Campbell Scott, of the C. & C. Electric Company, presided, and Mr. C. C. Warren, of the Warren Electric Manufacturing Company, Sandusky, Ohio, acted as secretary.

The following companies were represented at the meeting by the gentlemen named below:

C. & C. Electric Co., New York, Campbell Scott; Warren Electric Manufacturing Co., Sandusky, Ohio, C. C. Warren; Jas. Clark, Jr., & Co., Louisville, Ky., Jas. Clark; E. G. Bernard & Co., Troy, N. Y., E. G. Bernard; Keystone Electric Co., Erie, Pa., J. W. Leech; Akron Electric Co., Akron, Ohio, S. A. Sague; Belknap Motor Co., Portland, Me., W. Pimlott; Commercial Electric Co., Indianapolis, Ind., S. L. Hadley; Crocker–Wheeler Co., New York, C. H. Wilmerding; Eddy Electric Manufacturing Co., Windsor, Ct., M. E. Baird; Elwell–Parker Electric Co., Cleveland, Ohio, F. C. Phillips; Ft. Wayne Electric Co., Ft. Wayne, Ind., F. S. Hunting; Holtzer–Cabot Electric Co., Brookline, Mass., E. R. Harding; Milwaukee Electric Co., Milwaukee, Walter Cary; Northern Electric Manufacturing Co., Madison, Wis., A. O. Fox; Siemens & Halske, Chicago, C. S. Knight; Triumph Electric Co., Cincinnati, Ohio, J. C. Hobart; Quaker City Electric Co., Philadelphia, W. S. Jones; Wagner Electric Manufacturing Co., St. Louis, Mo., E. F. Abadie; Roth Bros., Chicago, Roth Bros.; Western Electric Co., Chicago, C. B. Waite; Sprague Electric Co., New York, E. B. Kittle.

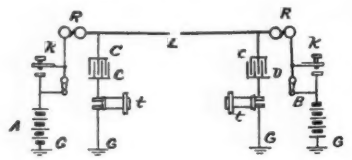
In addition, the following-named companies were invited to be present, but were unable to do so: Thresher Electric Company, Dayton, Ohio; New England Motor Company, Lowell, Mass.; Eagle Electric Works, Peoria, Ill.; Jenney Electric Manufacturing Company, Indianapolis, Ind.; Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., and the Connecticut Motor and Dynamo Company, New York.

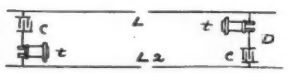
On September 20 another meeting, at which the General Electric Company was represented, was held. It is said that no definite plan was adopted, but a meeting was called for the purpose of forming a permanent association, and this meeting will be held in New York about October 20.

SOME INSTANCES OF COMPOSITE TRANSMISSION AND COMPOUND TELEPHONY.*

BY THOMAS D. LOCKWOOD.

Two systems which involve the use of the speaking telephone have long been associated in the minds of those who are engaged in thinking out telephonic problems; rather I





FIGS. 1 AND 2.

think because they both comprise simultaneous multiple transmission of one sort or another, than that they really have much in common. One of these may properly be termed Compound or Multiple Telephony; and the other, which has gone very considerably into commercial use, has become known as Composite Transmission.

After acceding to the request of Mr. Evans that I should write a paper for our association meeting, and determining that the present subject would be as good a one as any other, I became apprised—through the electrical journals—of the fact that Mr. Selden was booked for a paper relating to the same line of work. I concluded, however, to proceed, since there is ample room for two in the subject, and since I saw no probability that they could turn out exactly alike; and saw also good reason to hope that each paper might in some sense be supplementary to the other.

Under the title Compound or Multiple Telephony, I class all such systems as are organized or arranged for the simultaneous transmission of two or more telephonic messages over the same wires; and by Composite Transmission, I mean any system wherein it is sought to send telegraphic and telephonic messages over the same wires at the same time.

As might naturally be expected, since telegraphy was first in the field, the first practical attempt at any kind of double transmission in which the speaking telephone was concerned is referable not only to the latter class, but was moreover one in which it was sought to make available for telephonic purposes, circuits previously established and in use for telegraphic purposes.

This attempt, which met with some success, was made jointly by George Black, then manager of the Montreal Telegraph Company's office at Hamilton, Canada, and A. M. Rosebrugh, a practicing physician of Toronto.

As copies of patents are readily procurable for a small sum I shall not scruple to refer to them, wherever I think it advisable, so that any one especially interested in the subject generally, and desiring more information, may send to the Patent Office for such copies.

The Black and Rosebrugh patent is No. 212,433, granted February, 1879, to George Black and A. M. Rosebrugh, for what is termed An Improvement in Electrical Telephony.

The essence of the plan was that there might be one or more telegraph wires working as independent grounded circuits as usual; and that these might at any two desired points be provided with extra ground branches, or bridges, each including a condenser and a telephone.

Fig. 1 indicates the application of this plan to a single telegraphic circuit, and Fig. 2 its application to two telegraphic circuits.

L is the main line and A and B are

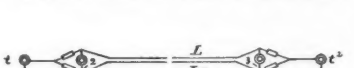


FIG. 3

telegraph stations fitted with relays and keys as usual, and terminal batteries. C and D are other stations, where branches run to ground, each through the condenser *c* and telephone *t*. Fig. 2 merely exemplifies the idea in another way. Here are two parallel telegraph wires L and L2; their telegraph stations are not indicated, and the telephones *t* and condensers *c* are arranged in bridges between the two line wires. The telephones shown represent the usual entire telephone outfit.

The telegraphic currents can not, of course, pass the condensers, as there is no conduction from one side of them to the other, but the telephones find no trouble in operating through the condensers by waves of electrostatic induction.

The only practical installation of this system that I know anything about occurred in 1878 and 1879 at New York, on the metallic call box circuits of the American District Telegraph Company.

Here there might be some 65 or 70 call boxes on a circuit; and at one or more of these a telephone was installed as shown above; a ground branch being extended from the metallic circuit conductor for that purpose.

It was a pretty bright thought for the time, and might serve now for some temporary exigency. In the particular installation mentioned above, it answered the purpose, and worked pretty well, as long as the circuit was quite free from grounds. And there was no material interruption by sending signals, because the main circuit was metallic, and there was, therefore, always the other way round. But I should not expect any satisfaction from the arrangement, if associated with a regular Morse line. Of course, the telegraph proper had to be used as a call.

Those of us who have studied the telegraphic duplex and quadruplex systems will not be surprised to hear that the principles underlying them were next thought of as being possibly available for compound telephony, and also for composite transmission. In those systems, as you will remember, the cardinal and underlying thought is that the home receiver must be either so placed in the circuit, or so constructed, that it will be utterly neutral and irresponsive to the transmission of the home key, or to the outgoing message, while remaining fully under the control of the key at the distant station and therefore fully responsive to incoming messages.

And this has been arranged in two ways. The receiving instrument has been wound with two equal coils, one in the main circuit and the other in an artificial line, these being so arranged that the act of sending from its associated key will transmit the

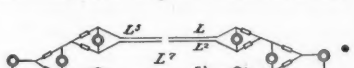


FIG. 4.

current through both in opposite directions, thus avoiding any effect at all; while the transmission of the distant key affecting the line coil only, will operate the instrument.

Or, the receiving instrument unchanged in itself, has been placed in a bridge, between the main and artificial line, so that no current will pass through it when the home key is operated; while the changes of main line current produced by operation of the distant key act upon it perfectly. These two forms of duplex are of course widely known as the "Differential" and "Bridge" duplex systems.

Both of these ideas—both however coupled with a third—that of combinations of line wires, are utilized in the Jacob telephone system which made its appearance in 1882–1883, and is generally described in a United States patent, No. 287,288, granted to Frank Jacob, October 23, 1883.

Fig. 3 illustrates the plan devised by Jacob for the simultaneous transmission of two telephonic messages over the two wires of a metallic circuit. One set of telephones employs the two wires in series forming the metallic circuit, and in this case the current at any definite moment may be conceived as going over one of the wires, and coming back over the other. The other set of telephones employs the two wires in parallel, using them in fact just as one conductor of twice the size of either alone. Some of us will no doubt recollect this as an expedient which years ago, in the days of bad or worse insulation, was occasionally adopted to help out in bad weather.

In the sketch L, L2 are the line wires T, T2, the telephones in metallic circuit, and *t*, *t* the telephones in the ground wires extending to the ground connections from each end of the metallic circuit, and T, T the telephones in the ground branches. The metallic circuits complete themselves through the cross-wires or bridges 2, 3; and to prevent the short circuiting of the telephones in these bridges, suitable resistances are introduced into each side of the circuit between the bridge and the ground branch 4.

In this arrangement the telephones T, T2 talk together, and the telephones *t*, *t*2 also talk together, without reciprocal interference, provided the line is balanced. But with ordinary care there need be no particular trouble in constructing and operating this arrangement for moderate distances. It is clearly a bridge telephonic duplex.

It can, at least experimentally, be made to comprise two elementary metallic circuits, and then, arranged as in Fig. 4, can be formed into four distinct circuits. The sketch requires little additional explanation. One message can be sent on the upper metallic circuit, of which L and L2 are the direct and return wires; a second, in like manner can be sent on the lower metallic circuit, using one of the wires L3, L4 as the outgoing, and the other as the return conductor. A third circuit combines the wires L, L2 to form its outgoing conductor L5, and the wires L3, L4 to form its return conductor L6, and finally a fourth circuit L7 is made up of all four wires in parallel to serve as the

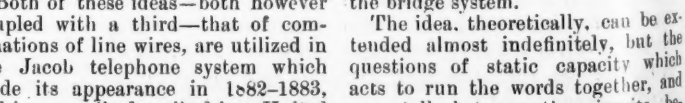


FIG. 5.

line conductor; this circuit having a ground return. Here again we have the bridge system.

The idea, theoretically, can be extended almost indefinitely, but the questions of static capacity which acts to run the words together, and cross-talk between the circuits, be-

* A paper read at the Wilmington meeting of the Association of Railway Telegraph Superintendents.

come serious ones as soon as we reach even the four wire structure just described.

In these plans both or all messages may be telephonic; or, some telephonic and some telegraphic.

A more satisfactory plan, however, for a composite circuit for one telegraphic and one telephonic circuit is that shown in Fig. 5.

In this plan the differential expedient is employed. The receiving telephone is wound differentially, both coils being serially in the metallic circuit in such relation as to reinforce each other. From a point at the exact middle of the two coils a branch at each end of the line runs to the telegraph outfit of key, relay, battery, etc., and then to ground. So that here we have a metallic telephone circuit giving the best results and a grounded telegraphic circuit, whose line conductor is made up of the two telephone wires, joined in parallel. The telegraphic signals do not affect the telephone because, as the telegraph terminal branch is attracted to the middle of the winding, the battery current divides, half going round the telephone core in each direction, so as to give a result of zero. Of course, the two parts of the telephone winding are to be as nearly equal in their influence over the core as can be, and, since it is difficult to get them exactly equal, it is found advantageous in practice to insert a small rheostat on each side or in each half of the receiver winding to aid in balancing.

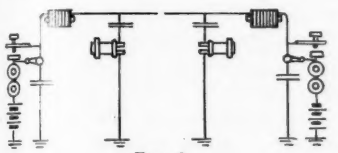


FIG. 6.

This is a highly practical system, and may often be found useful. Though the Jacob systems were patented, the patent has expired, and any one may if they please employ the combinations described therein.

I have had the opportunity to try the multiple telephony form of this style of operation; and such trials as have been made indicated that in operating it, cables instead of loose wires were desirable.

In the period extending from 1882 to 1885, the Van Rysselberghe plan of Composite Telephony and Telegraphy made its appearance. This can only be worked to advantage when the wires of both systems are under the same control. Its inventor, F. Van Rysselberghe, of Belgium, operated it at first, by means of ordinary grounded circuits; and in that condition over each wire one telephonic and one telegraphic message could be at the same time transmitted.

Fig. 6 indicates the plan of construction. The line wire at each telegraphic end station leads first through an electro-magnetic resistance, then through the key, relay and battery to ground. From a point outside of the telegraphic connections the telephone instruments are connected in ground branches, a condenser being interposed between each telephone branch and the main line. A condenser was also provided in a ground branch from the key. This grounded circuit was not a perfect one by any means. The telephones were disturbed partly by outside induction, and partly by the telegraphic impulses of the same circuit; and the telegraphic circuit worked hard, by reason of the attachment of the telephone branch.

But the system when installed showed possibilities, and when refined and applied to metallic circuits it has proved capable of doing good service.

The principles underlying it are these: There must be something to separate utterly the two classes of currents or signals; while leaving both in good connection with the line.

Also something to cut off the corners, so to speak to graduate, smooth or suppress the abruptness or sharpness of the telegraphic impulses, and thus prevent them from disturbing the telephones.

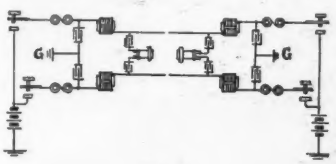


FIG. 7.

Also something to prevent a too free earth connection for either class, so that both services may have an equal chance and neither be short-circuited through the other.

For the first, the condenser comes into play, and this is placed between the telephones and the main line. The telegraph battery currents while charging the condenser are prevented by it from short-circuiting through the telephones; while its presence—if of proper capacity—does not at all obstruct the telephone work.

For the second, electro-magnets are interposed in the telegraphic parts of the circuit nearer to the end than the point of the telephone connection, and these oppose the passage of the telephonic currents much more than they do the telegraphic currents, forming in effect an almost absolute barrier to their passage; so that these also are thus prevented from short-circuiting through the telegraph instruments at the home station. The magnet of the telegraphic receiver is also made of high resistance and impedance to aid in this work.

FIG. 8.

And for the third, resistances may also be added to the telephone branches.

A suitable capacity for the separating condensers is stated to be about one-half of a microfarad, and it is also said that the electro-magnets should be wound up to 500 ohms, or more. The condenser branched from the key to ground which is intended to further mask the telegraphic impulses, should have a capacity, so Van Rysselberghe states, of two microfarads.

Van Rysselberghe, however, went further than this, making a really high-class system of composite operation, wherein three messages can simultaneously be sent over two wires. This is described in the United States patent, No. 323,239, of July 28, 1885.

In this arrangement the two wires are connected at their ends to form a metallic circuit for the telephones, while each of the wires can independently be used as a telegraphic grounded circuit. Fig. 7 illustrates the idea. When this plan is adopted, the additional advantage is attained (for the telephone) that induction is neutralized; especially when the two wires are twisted or transposed.

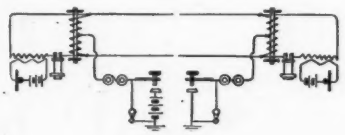


FIG. 9.

The telephones at the two stations are placed in bridge wires extending between the two mains, a condenser being interposed on each side of each telephone. Thus, the telephones have a circuit clear from electro magnets, and containing four condensers.

Each line wire at its ends is led successfully through an electro magnetic resistance, the relay, the key and battery to ground; and from a point between the electro-magnetic resistance and the relay, a bridge containing two condensers extends between the two mains, and is provided with a ground connection leading from a point between the condensers.

When care is taken to balance the lines, and to properly proportion the condensers and magnetic retardation, or impedance coils, the two classes of transmission can be handled very efficiently and without material interference by this method.

Before leaving Van Rysselberghe, I think I should refer to another plain, whereby a short telephone circuit may be ingrafted so to speak, on two telegraph line wires between two way stations. This is shown in Fig. 8.

This view is mainly self explanatory. Between the telegraph instruments of the two lines at the two stations concerned, the two telephone connections are made, each telephone bridge including two condensers, one on each side of the telephone, as in the other cases. And between the telephone bridge connection and the nearest telegraph outfit there is placed in each linen an impedance or electro-magnetic coil, as shown, to prevent the telephonic currents from splitting and going in part along the line in the wrong direction. The condenser and ground bridge to aid in subduing the telegraphic interference is used in this plan also.

I should suppose that some such mode as this last might often be found practical and useful. Entire sets could be arranged to be easily connected with pairs of lines, and set up to form temporary telephonic installations.

But what I think is a more practical arrangement than any of those so far described is that illustrated by Fig 9.

Here two line wires forming a metallic circuit are employed in the usual manner as a telephone circuit. But a coil wound over an iron core, and having a high resistance and inductance, is bridged between the two main conductors at the desired points, and to the center of its winding is attached a branch to earth containing the Morse relay and key. A battery also is included in one or both terminal branches.

The telegraphic circuit then is a grounded circuit utilizing both lines in parallel as its line conductor. The impedance coil does not exercise any appreciable effect on the telephone circuit, and provided the two wires are properly balanced, the telegraphic signals are not at all heard in the telephones. Moreover, since the telegraph circuit parts from the impedance coil winding at its center, the current traverses the coil in both directions and consequently the coil offers little impedance to it.

This expedient works well if set up carefully, with either telegraphic or telephonic instruments in the grounded circuit, and hence can be made useful in many cases for the transmission of two telegraphic messages over the same two wires at once. It has been used to some extent by telephone companies as a means for carrying office messages over wires regularly engaged in serving the public. This plan of construction was, I believe, first suggested by one Conti, an Italian, who published a description of it in 1883, but a close observer will see, of course, that its principles

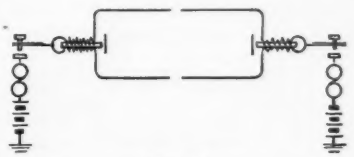


FIG. 10.

are to be found in the differential modification of Jacob's arrangement.

It was, however, quite crude when left by Jacob, and required a great deal of working out, in order that it might be brought to its present stage.

This plan, also, has been adapted to way work. Fig 10 illustrates such an adaptation made by Mr. John J. Carty, wherein the usual metallic telephone circuit extends between two terminal stations, at each of which it is fitted with telephone instruments.

The line may be divided into one, two or more sections, by arranging at

one or more pairs of stations, retardations or impedance coils in bridge between the main conductors, and connecting the centers of the two bridges of a pair, by a return conductor or ground, the extra instruments, either telephones or telegraph instruments as the case may be, being introduced into the way circuit thus formed, at the ends.

In this plan the sections used of the two wires of the telephone circuit form together one side of the new way circuit, and the conductor joining the coil centers forms the other.

In any of the cases to which this paper refers where a ground return has been spoken of, a wire return can of course be used.

And a little thought will show that the ground extensions of the extra circuit can be extended as desired to any reasonable length.

I do not assert that I have mentioned any new plans, and I think it very likely that some, perhaps all, of the arrangements of which I have spoken, may be familiar to several persons here. But it is sometimes well to know what has been done: First, that we may repeat the old work, if we so desire; and second, that it may give us suggestions for new work. There is plenty to do yet. Few, if any, plans of combining the telephone with the telegraph has considered that telegraph lines, and especially railroad telegraph lines, are already so loaded down with stations, that to give them any more to do would be imposing upon them something more than a "white man's burden."

When you and your best men do get thinking these matters over, with a view to applying them to your own systems and problems, I venture the prophecy that you will surprise yourselves by the number of ideas which unbidden and unexpected will speedily present themselves, all crying, "Try me!"

PERSONAL.

Mr. Geo. A. McKinlock, president of the Central Electric Company, of Chicago, is visiting New York city to enjoy the yacht races.

Mr. W. S. Hine, of the Western Electric Company, Chicago, is visiting New York city this week, and renewing acquaintance with his many friends.

Mr. L. G. Martin, former manager of the cable office at Bermuda, and who also was in charge of the cable office at Jamaica during the Spanish-American war, where he handled his important duties to the satisfaction of all concerned, has decided to come to the United States and join the staff of the New York & New Jersey Telephone Company. Both the company and Mr. Martin are to be congratulated on the union, and the ELECTRICAL REVIEW takes much pleasure in extending to Mr. Martin its best wishes for success.

BRITISH ELECTRICAL NEWS.

[*From our special correspondent.*]

The event of the week, from an electrical point of view, has been the paper read by Professor Fleming on Monday night before the British Association at Dover, in which he reviewed the progress made in electrical science during the century which has elapsed since the great discovery of Volta. The professor was dealing, of course, with a non-technical audience—or an audience the majority of whose members were non-technical—and he had accordingly to explain several matters which to trained electricians are truisms. He could not answer the old conundrum: "What is an electric current?" but he told his audience what it was not, and thus cleared away some misapprehensions, though it is possible that he bewildered some of them considerably in the process. In a general way, he explained, it might be necessary to have a conducting wire, but the action of the electric "current" was much more outside the wire than in it, and there was no resemblance between the action of an electrically charged wire and the flow of water through a pipe. There were plenty of illustrative experiments, and the working of the Marconi system of wireless telegraphy was shown by a complete apparatus which was set up upon the lecture table, connected to a flagstaff erected upon the tower of the hall, by which he communicated with the president of the French association at Wimereux, and thence, by land wire, with the president of the congress which was assembled that day at Como, receiving replies couched in similar friendly terms. (You will doubtless observe that though we in England share with Americans the general indignation at the Dreyfus scandal, French and English *savants*, at all events, are upon terms of undiminished cordiality. This is, of course, as it should be, for science knows no politics—theoretically, at least.) The Professor exhibited one of the latest and most ingenious applications of the power to close the circuit of a voltaic battery by merely making an electric spark at a distant place, and he went on to explain how explosives could be fired and torpedoes steered by means of etheric currents without the assistance of connecting wires. Referring to the success of the wireless telegraphy experiments of several months since for maintaining communication between lightships and the shore, he pointed out that though it was six months since the Trinity House scientific advisers recommended the adoption of the system for this purpose, nothing had as yet been done. Governments, however, are difficult to move all the world over; indeed, the dilatoriness of the State has, I am told, been the subject of occasional complaint in America itself. When some serious disaster involving loss of life has occurred, it is possible that public opinion may force the somnolent gentlemen who settle these matters to make some sign. Until then it would not be wise to expect much.

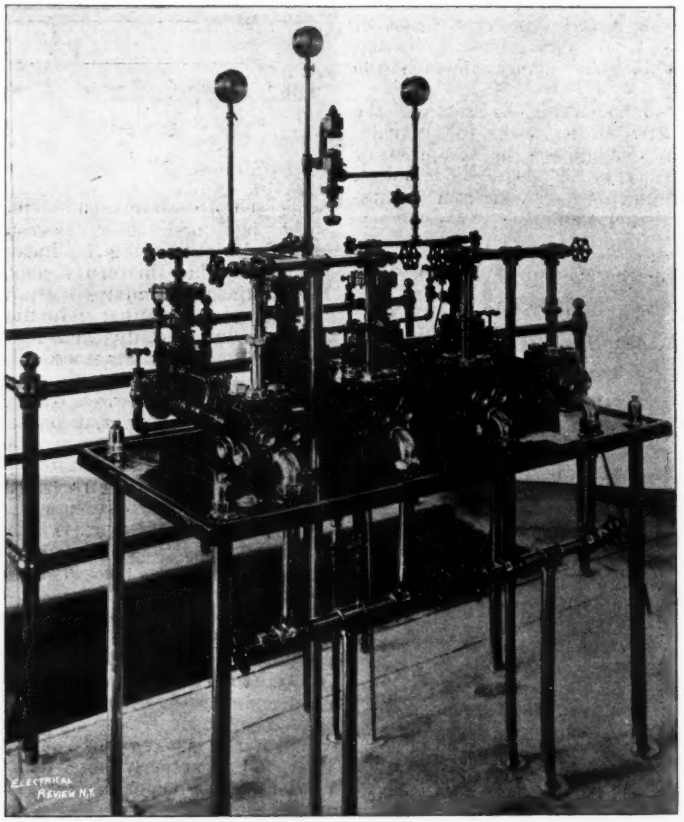


FIG. 1.—OILING TABLE OF AN AUTOMATIC OILING SYSTEM.

The mechanical science section was mainly occupied with the application of electrical power to mechanical needs. Mr. A. Siemens spoke strongly in favor of an extended application of electricity for subsidiary work outside the engine and boiler-rooms on shipboard. A brisk discussion followed, at the close of which Sir William White, the Admiralty constructor, spoke up for his department, stating that electricity was not suitable for all board-ship purposes, and that the Admiralty were never—no never—backward in utilizing it when possible or practical. I believe it is a fact that the meeting winked as one man, but the reporters have omitted to chronicle the circumstance, probably as being beneath the dignity of print. Another important matter discussed in this section was the new system of railway signaling, devised by Mr. W. S. Boult. Mr. Boult had no difficulty in showing the grave defects in the present system, which he described as a mixed collection of semaphores, lamps and torpedoes, the working of which was rendered more and more uncertain as the speed of the trains increased; and he proposed to substitute for these magnetism, without mechanical contact between traveling and stationary points. By his system magnets would be so arranged on the road as to deflect a pivoted needle and thus close a local circuit on the engine. It would at first supersede torpedoes and human agency for fog signaling. Mr. Boult was listened to with great interest.

The Liverpool press is divided as to whether to charge a recent accident on their tramways to electricity or to your countrymen. It seems that a large dray, laden with American bacon, contrived to break down in such a position that it blocked both lines of traffic, and the electric tramway service was stopped for some time, the cars being picturesquely

grouped upon either side of the peccant dray. Some papers lay it to the charge of this new-fangled electricity, and others of a patriotic turn of mind desire, I am told, to make an international question of it. Probably the former will prevail. Any stick is good enough to beat a dog with, and things electric are still viewed with grave suspicion by the conservative gray-heads amongst us. By the time

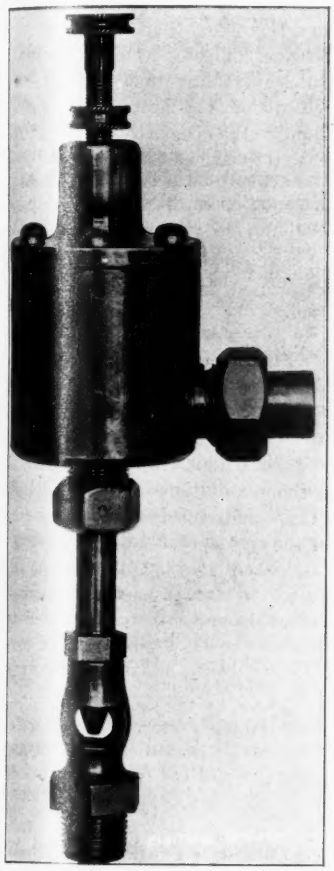


FIG. 2.—OILING CUP USED WITH AUTOMATIC OILING SYSTEM.

that you have found some new force to take its place our rank and file will be getting reconciled to its presence.

There has been some excitement among the postal authorities at the discovery of a long-lost tunnel, leading from the General Post Office in St. Martin's le-grand to the great railway station at Euston, a distance of more than two miles. The tunnel is about four feet in diameter, and was originally built in 1859 by the Pneumatic Dispatch Company, for the purpose of carrying mails and parcels. The system proved, however, to be faulty, and the scheme and the tunnel were abandoned. It is now proposed to run an electric train through it for the original purpose, and Professor Carus-Wilson is busy designing the said train. The tunnel will also be lighted electrically, and it is intended to have a service which will cover the distance in less than five minutes. In private hands there is no doubt that this would be accomplished without much loss of time; but the party to be consulted in this instance is the Post Office, and the Post Office is a very steady and stolid department. Still, one should never lose hope.

The Swiss tour of our Institution of Electrical Engineers appears to have been a decided success, and our folks seem to have realized more fully than heretofore how seriously we have been outstripped by this little land of Switzerland in electrical development. The *Electrical Review*, the exponent of the best opinion in electrical circles, has a thoughtful and well written leader on the subject in its current issue, which should meet with considerable attention at the hands of those concerned in this country. "We conclude, then," writes my contemporary, "that we are many years behind the Swiss in the manufacture and use of polyphase machinery, while they lead the world in this department; nevertheless, we are at least abreast of them in the construction of direct-current and single-phase machinery. Their turbines are unexcelled; but so are our engines and turbines. . . . We have seen no cause to suppose that our less forward state is due to any deficiency in the talent or inventive genius of our engineers." My contemporary writes forcibly upon the hindrances to which electrical enterprise is exposed in this country by the ignorant and perverse opposition of the municipal and other authorities to all electrical developments. This is too complex a question to enter upon in this place, but nobody who has followed the struggles of the electrical industry over here to get a footing will accuse my contemporary of overstating the case, the hardship of which you in America can scarcely form anything like an adequate idea. "Still we see," as my contemporary observes, "London destitute of electric tramways, and our toilers crowded in mephitic tunnels, 15 to the compartment." In Switzerland, of course, as in most civilized countries, there is nothing of this. Engineering projects are popular and their advantages appreciated; capital is readily invested, and the people support them willingly. Hence over there electricity advances by leaps and bounds, while it might almost be said that it "seems here no painful inch to gain." The British nation, in short, is in fault, not the engineer.

London, Sept. 25.

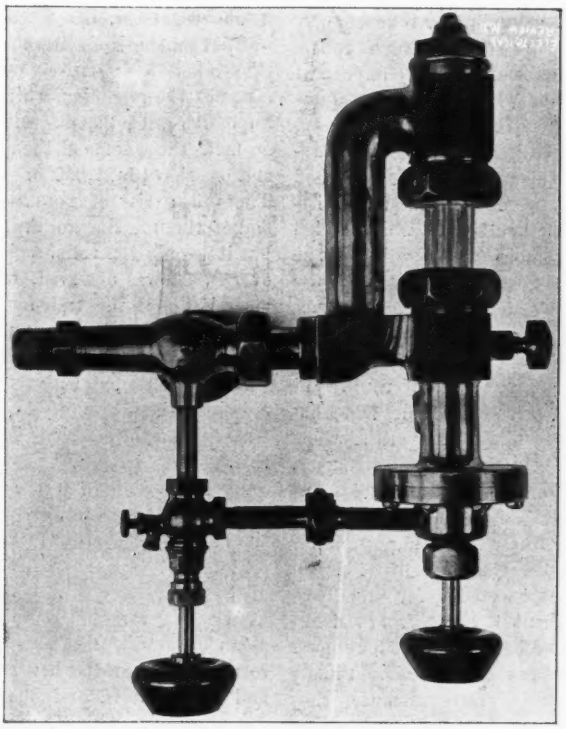


FIG. 3.—CYLINDER LUBRICATOR USED WITH AUTOMATIC OILING SYSTEM.

An Automatic Oiling System.

In extended plants where a large quantity of machinery is looked after and where small economies are properly considered by those in charge, the question of the economical distribution of oil is one of much moment. The system herewith illustrated is of the general type of high-pressure feed oiling installation, but is worked out with great care in its details, and possesses several points of novelty and merit. Fig. 1 shows what is known as an oiling table. On this is installed a battery of four small pumps. These are steam driven and are of the duplex pattern, and are so connected that two are used for cylinder oil while the other two are used for engine oil. In planning the table for a given plant the capacity of the pumps is made such that one pump working on each variety of oil is sufficient, the other standing in reserve so that there may be no possibility of a failure of the oil supply. On top of the steam chest of each pump is a governor which may be regulated to maintain any desired pressure on the oil supply. From this apparatus small brass or iron pipes of about a quarter-inch diameter are led to the various parts of the plant and connected with sight-feed lubricators, in the case of the engine oil, and with a special type of cylinder-lubricator on the steam-pipes of the engines. The sight-feed lubricator consists of a cylindrical reservoir in the bottom of which is a small cone valve. The stem of this is attached to a flexible diaphragm which closes the top of the oil-cup, and over this is screwed a lid by which the movement of the diaphragm and, consequently, the opening of the valve may be regulated so that the flow of oil is either a steady stream or occasional drops, as the necessities of the case demand. When the oil at pressure is allowed to enter the cup the diaphragm is sprung forward, the valve opened, and it flows through the sight-feed, which permits the man in charge to note the amount being fed into the bearing. Fig. 2 is an excellent illustration of the general outlines of this oil cup. The cylinder-lubricator is shown in Fig. 3. This is very similar in action, a balance of pressure being maintained between the steam in the steam pipe and the oil in the feeding pipes. It is of the inverted type, the feed of oil flowing upward through water contained in the glass tube so that the amount supplied may be noticed. This system is made by the Siegrist Lubricator Company, St. Louis, Mo., and has been installed by them in a number of large electric and other stations. It is stated that the saving effected is such as to be worthy the careful consideration of the management of similar plants.

TESTS AND CALCULATIONS FOR A FORTY-MILE ALUMINUM-WIRE TRANSMISSION LINE.*

BY F. A. C. PERRINE.

Running from the Blue Lakes power-house near the Big Bar bridge on the Mokelumne River to the Stockton substation is the line to which reference is made. It is that of the Standard Electric Company, of California, and it is particularly pertinent to report on the tests of this line because there has been a great deal of talk about there having been a failure of the wire. The line extends from the Blue Lakes plant on the Mokelumne River to the substation in Stockton, a distance given by the engineers as 43½ miles. The line was designed to deliver 1,000 kilowatts at 8.8 per cent C^2R loss, the line being two-phase; arranged at the corners of a rectangle—not a square; one side of the rectangle being 24 inches, the other side 41 inches, giving a distance between phases of 46 inches. This peculiar arrangement was adopted on account of the fact that the line was intended subsequently to be changed to a three-phase line, and to form with two additional wires two three-phase lines on the one-pole line; the wires being then set at the corner of a hexagon, giving a distance of 41 inches between the wires of the same phase.

At present the two-phase line occupies four pins, and subsequently it is to occupy but three of the pins when the line is changed to three-phase. All of this was made necessary by the character of machinery, and also to overcome some of the difficulties which were anticipated in connection with the rapid building of the line, which rapid building was made necessary by the condition of the weather. The work began last November, and no one had reason to suppose that the Winter would be open, which it proved to be.

The wire is 294 mils in diameter, or 86,433 circular mils in area, weighs 419.4 pounds per mile, and the ultimate tensile strength of each wire is 1,539 pounds, or 22,700 pounds per square inch. The stress at one per cent elongation is 800 pounds; conductivity by dimensions is 59.9 per cent of Matthiessen's standard for soft copper. These quantities are obtained from the tests of a large number of samples. You will notice no elastic limit is given, but the stress is at one per cent elongation. This is on account of the fact that, in common with copper and metals of a similar character, aluminum has no well defined elastic limit. As compared to a copper wire, this is the same as a No. 6 B. & S. in weight, a No. 5 in breaking stress, a No. 3 in resistance and a No. 1 in capacity and inductivity. It is the same size as No. 1, and its resistance an equivalent to No. 3. But while it has only the weight of a No. 6, it has the breakage strength of a No. 5, so as regards the necessary strength in a span, the wire is equal to a copper wire of about 70,000 pounds tensile strength, or a steel wire of about 60,000 pounds tensile strength, steel, of course, being lighter than copper.

Taking up the question of resistance, which is exceedingly important as indicating whether this wire of low tensile strength, which was strung in warm weather and had been subjected to extremely cold weather, had stretched, we found that the resistance of the line was 92 ohms, which is the resistance for 42.8 miles. The engineers gave the length of the line as 43½ miles, so the resistance was about seven-tenths of a mile shorter than the measured distance. I am strongly inclined to think that this is on account of the fact that the engineers have chained the whole distance by individual pole distances, attempting to set all the poles 132 feet apart, and that when they came to a place where it was impossible for them to set them exactly 132 feet apart, they selected a favorable location at about 132 feet from the last pole; so we have some few long spans and some few short spans. Finally obtaining the entire distance, they counted the poles, and, multiplying by 132, obtained a distance of 43½ miles. Whatever may have been the reason for the difference between these measurements, that difference in size and direction indicates very clearly that there was no permanent elongation of the wire during the cold weather.

The next test is one referring almost entirely to the insulators and the condition of the wire during bad weather. Fortunately there was some extremely bad weather during the time the tests were made on this line. The insulation of one wire against the ground was found to vary from 160,000 ohms on a rainy day to 44 megohms on a clear day. In fact, on one day during a shower the line would vary in a couple of hours all the way from five or six megohms down to a quarter megohm, but, under no conditions, falling below 160,000 ohms.

As regards capacity, wires one and two tested alone called for $3\frac{23}{100}$ microfarads as calculated, and the measure was $3\frac{35}{100}$. As regards the self-induction, $\frac{164}{10000}$ by calculation and $\frac{17}{100}$ by measurement.

There has been one point observed which has not anything to do with the line in a sense, but in another sense it has. And this was that the effect of the self-induction and capacity is to over compound the step-up transformers. The step-up transformer ratio is 2,300 to 25,000, and the step-down ratio 23,000 to 2,200, with a possible variation of 200 volts in the regulator, but when current was put on the line without any load the voltage went entirely out of the range of the regulator, which seemed impossible with 25,000 volts initial. In fact, the voltage at the step-down station showed 27,000 on the line. There is a rise of potential at the end of the line due to the capacity, but it is only 200 volts, and a rise of over 2,000 was observed, which was entirely due to the transformers. A calculation from the constants of the transformers accounts for all but 200 volts of the rise, and an error in calculating the angle of lead in the transformer may easily account for this.

By calculation from the line constants it is seen that, at no load on the step-down transformers, the current leads the electro-motive force by about 83 degrees. With 83 degrees lead, the electro-motive force at the secondaries of the step-up transformers ought to be between 26,800 and 27,000 volts, and about 27,200 was observed. This effect is likely to appear in a very odd and more or less serious manner on long lines.

During these tests it was found that the capacity of the line varied materially with the state of the weather. The capacity between two wires would run all the way from three-tenths of a microfarad to .9 microfarad—three times its value—depending on whether it was raining or whether it had stopped raining, and so forth. If this occurs when the circuit is lightly loaded the current will swing clear around from lagging to leading and without a single change in the load, simply due to changes in the condition of the line, the electro-motive force will go up and down. This is a condition to be provided for in our regulation, and calls for more regulation than has been commonly put in any of the substations. The substation regulation is commonly figured out to be ample for the changes of load, but it follows that you must not only regulate for possible changes of load, but also for possible changes in the condition of the line which will throw the current from lagging to leading.

* A paper read before the third annual convention of the Pacific Coast Electric Transmission Association, San Francisco, June 20-21, 1899.

That Third Avenue Railroad Cement.

TO THE EDITOR OF ELECTRICAL REVIEW:

We note in your current issue, under "Views, News and Interviews," an article about cement used on Third Avenue Railroad, New York city, in which it is stated that no more of the cement of the brand used can be found. We beg to state that the cement furnished was of the "Globe" brand, of which at that time the Manhattan Cement Company were the exclusive agents, and which we, as their successors, now control. Some 40,000 barrels of this same brand were used in the Broadway cable road.

SPARROW, FRIDENBERG & Co.
New York, Sept. 25, 1899.

Artificial Lighting in 1832.

[*From the Hartford, Ct., Courant.*]

Back in 1832 Hartford was treated to some exhibitions of "artificial lightning," and, no doubt, the residents of the city at that time were properly astonished at what they saw. But they didn't see in what was then put before their eyes the precursor of the modern electric light, and they would have doubted if they had been told that sixty years later the streets would be lighted by the same agent. President James Bolter, of the Hartford National Bank, cut the following advertisement from an old copy of the *Jeffersonian*, a democratic newspaper printed in this city many years ago:

ARTIFICIAL LIGHTNING

ON A GRAND SCALE.

The Public are respectfully informed that the subscriber has just completed an Electrical Machine, which is supposed to be the largest and most powerful one ever constructed in America. The effects are truly wonderful. In the evening, vivid flashes of lightning can be sent from it through any part of the room, and a continued stream kept up, that will render it sufficiently light to see distinctly to read the smallest print. A great variety of electrical apparatus is connected with the machine, together with an air pump and its appendages, for demonstrating by experiment the cause of those phenomena that take place in our atmosphere, such as clouds, thunderstorms, hail, snow, wind, meteors, etc., particularly that meteor called the northern lights.

Experiments will be performed with the above apparatus every evening, at the Hartford Museum, from the 31st of December to the 4th of January, inclusive, to commence at 7 o'clock

Admittance to the Exhibition and Museum, 25 cents, children, 12½ cents.

CALEB WRIGHT.

Hartford, Dec. 28, 1832.

The Hartford Museum was on the fourth floor of the old building that stood where the Hartford Trust Company's building now stands.

Telephone News .....and Comment

The Northwestern Telephone Exchange Company will erect a new exchange building at Winona, Minn.

Redwood Falls, Minn., will be provided with a telephone system by the Southern Minnesota Electric Telephone Company.

The Rocky Mountain Bell Telephone Company will expend some $200,000 in establishing its Salt Lake–Denver connections.

The Chicago Board of Review has added $3,135,000 to the personal assessment of the Chicago Telephone Company, thereby increasing its total valuation from $1,688,000 to $3,823,000.

The American Telephone and Telegraph Company has completed its lines into Little Rock, Ark., where connection is made with the wires of the Southwestern Telegraph and Telephone Company.

The Central Union Telephone Company is expending $25,000 in improving the local exchange at Anderson, Ind. The old system of batteries has been supplanted with the central energy system.

The Missouri & Kansas Telephone Company, of Kansas City, Mo., has voted to increase its capital stock from $1,250,000 to $2,500,000. The company will extend its lines and place its city wires underground.

The Southern New England Telephone Company, which a few months ago absorbed the Torrington, Conn., local telephone company, has removed all of the instruments used by subscribers of the absorbed company.

By October 1 the American Telephone and Telegraph Company will have long-distance connections between Superior, Wis., and the Bell system centering at St. Paul and Minneapolis. The company has refused to build across the river to Duluth, as that city had denied it a local franchise.

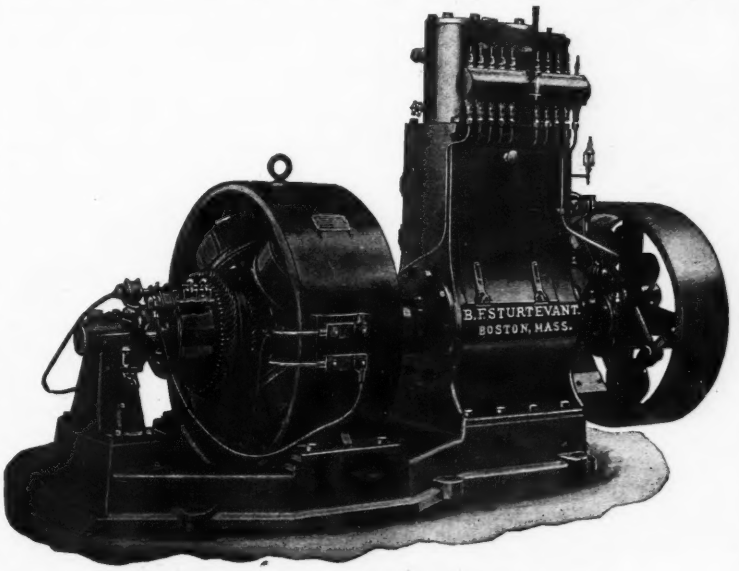
The Northern New York Telephone Company has adopted a new plan for increasing its business. Besides rebuilding all its lines and putting in long-distance instruments, giving desirable connections, it is now installing free telephones in the homes of subscribers having telephones at their business places and offices, giving two telephones for one price.

The long distance lines of the Southwestern Telegraph and Telephone Company at Waco, Texas, were formally opened on September 22. Successful conversations were had with Atlanta, Chicago, Cincinnati, Cleveland, Columbus, Detroit, Evansville, Indianapolis, Kansas City, Memphis, Milwaukee and St. Louis. About 400 of the representative citizens of the city were present.

The Chicago Telephone Company reports an increase of business exceeding anything in the history of telephone service in America, with the single exception of New York. At the present time the company is installing 750 new instruments a month. One of the greatest difficulties which the company has to contend with is the scarcity of the expert labor necessary for the underground wiring. Deliveries of high-resistance wire for relays and magnets are slow beyond all precedent, and the work in the shops is thereby impeded. At present the company can not obtain enough of the desk instruments to meet the actual needs of subscribers, and relief seems to be far distant.

The Supreme Court of Nebraska has rendered a decision to the effect that the State, acting through its legally designated agent, the State Board of Transportation, has the right to control the telephone companies of the State, compel a showing of earnings and fix rates for the monthly rental of telephones and tolls between towns in that State. The Legislature of 1897 placed telephone, telegraph and express companies on the same footing as regards State supervision and control as railroad companies. An Omaha Populist made a complaint, asking that rentals for telephones be fixed at $2 a month. The companies tried to enjoin the Board from acting with the result stated.

The Philadelphia Bell Telephone Company has installed at the National Export Exposition a private branch exchange for officers and employés of the exposition, which enables them to communicate with any telephone subscriber in Philadelphia and suburban towns, and gives connection, through the long-distance telephone, with any place that is reached by telephone lines. A special private line has been provided between the offices of the exposition and the Philadelphia Commercial Museum on Fourth street. The company has also established a pay station in the Main Building for the general public, and in addition to this a number of automatic stations have been placed in the different parts of the exposition buildings, at points most convenient, at which telephone service may be had at the regular pay station rates.



A Generating Set with Double Upright Engine.

Some capital anecdotes are told of Admiral Dewey by his friends in the October *Ladies' Home Journal*. They reveal the famous Admiral's characteristics more clearly than anything else that has been written concerning him. The anecdotes are printed with a number of portraits of the naval hero, and make a timely and interesting feature.

A Generating Set with Double Upright Engine.

When the ship Bay State was equipped by the Massachusetts Volunteer Aid Association for her praiseworthy efforts in connection with our late war, the type of generating set, illustrated herewith, was introduced for lighting purposes. This engine is of a type particularly desirable for such work, being double cylindered, with cranks set at an angle of 180 degrees so as to balance the reciprocating parts, and to permit high-running speed.

A single piston-valve regulates the steam supply of both cylinders, and materially simplifies the construction. The running-gear is rendered perfectly accessible through the door in the front, and all oiling is done from a single tank provided with independent sight-feed oilers and tubes to conduct the oil to the bearings. The governor is of the inertia type, and arranged to regulate the steam admission between zero and three-quarters cutoff.

Mounted on a common bed-plate with the engine is the generator, the armature of which is carried upon a common shaft with the engine, the outer end of the shaft being supported by a pedestal provided with a ring oiler.

The field ring is of cast steel provided with four poles, the series winding upon which is of flat copper ribbon, while the shunt winding is of wire. As is evident from the illustration, these windings are placed on the pole entirely independent of each other, so that they may be removed separately.

The armature is of the barrel-wound type with internal spiders which support the disks, and through which, in connection with the spaces left in the winding, a thorough circulation of air is produced when the machine is in operation, thereby keeping it well ventilated and cool.

The brushes are of carbon, the brush-holders being of the reaction type, and they are arranged for continuous operation without sparking at all changes of load up to 25 per cent overload. The design is such as to keep the temperature rise inside of 90 degrees Fahrenheit after 10 hours continuous run.

This set was designed, constructed and installed by the B. F. Sturtevant Company, of Boston, Mass. It is one of a series of sizes ranging from engines having each two cylinders, 3½x2½ up to 8x5½, with a corresponding range of output in watts from 4,500 to 32,000, and of weight from 1,650 to 9,000 pounds.

New Types of Power Motors.

The evolution of the electric motor from the high-speed, clumsy and unreliable machines of fifteen years ago has been very rapid but wonderfully thorough. To-day these machines are so entirely reliable and so perfectly fitted to their uses, that it is hard to believe that so short a time has seen their perfect development.

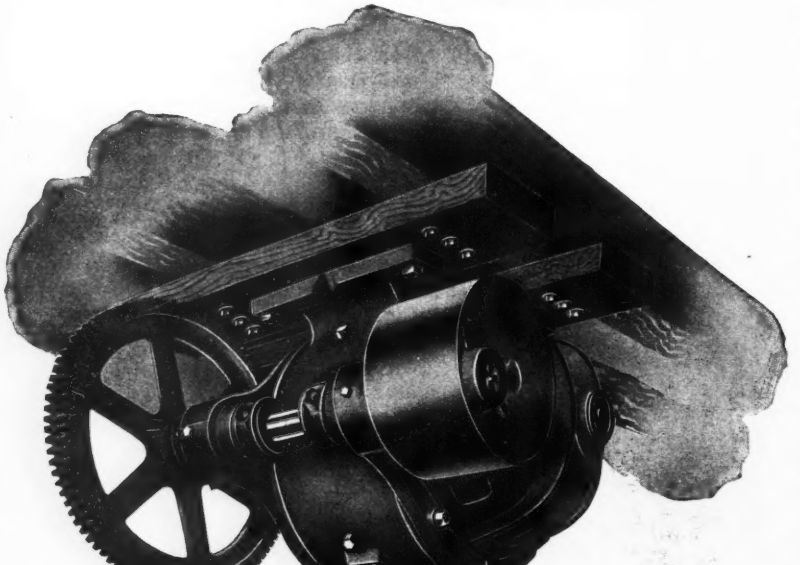


FIG. 1.—POWER MOTOR SUSPENDED FROM CEILING.

While the introduction of electric motors has been of gradual growth, their commercial possibilities and the economy of their use have been acknowledged for the past two decades, and the range of applications has increased with the development of the motors.

Motors are belted, direct-connected or geared to individual machines, each style being best suited to meet certain conditions. An illustration is shown herewith of an encased motor geared to a special screw-press by means of gear and pinion. In this illustration it will be noted that the motor is supported on a post. In another illustration will be seen a motor, with gear and pinion, suspended from the ceiling. In this special case, it shows the free end of the shaft provided with a pulley. Should the conditions so admit, another pinion could be placed upon the end, or the shaft could be direct-coupled to another shaft.

The Western Electric Company, Chicago and New York, manufactures encased, semi-encased and open motors, for 110, 220 and 500 volts, the open type being both bipolar and multipolar. Each type of motor is made for slow speed, intermediate and moderate speed. The encased and semi-encased motors are adapted for the reducing gear, as shown in the illustration above referred to.

In another illustration will be seen three encased motors of $\frac{1}{12}$, $\frac{1}{6}$ and $\frac{1}{4}$ horse-power, respectively. In a recent catalogue issued by the makers, is also given a complete list of slow-speed multipolar motors and dynamos of larger sizes, and dynamotors and twin motor generators. The catalogue contains some excellent information and instruction in regard to types of field winding and purposes for which they are adapted, also methods of controlling motor speeds.

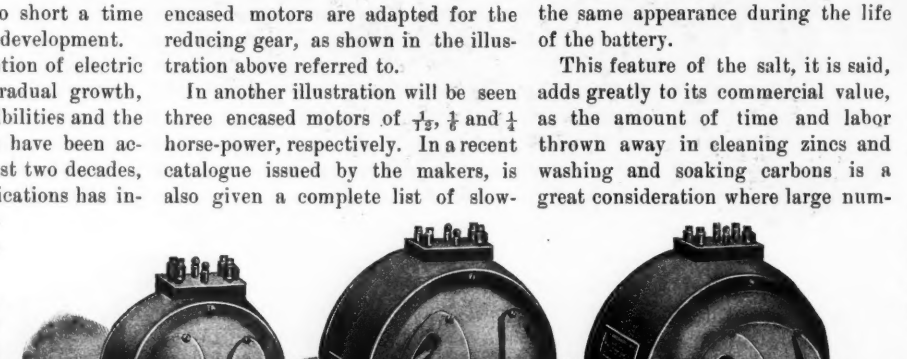


FIG. 2.—SMALL ENCASED POWER MOTORS.

All of the motors mentioned above are also adapted for use as generators.

A New Battery Salt.

There has recently been brought before the public a chemical compound, which is claimed by the inventors to be superior to sal-ammoniac and as harmless to handle. The commercial title of the compound is Federal salt; it is made by the Federal Battery Company, 11 Pine street, New York.

The many advantages gained by using this salt in all cells of the carbon-zinc type are said to be very apparent to those familiar with the disagreeable features of the sal-ammoniac cell. The new salt is said to increase the potential of the carbon-zinc cells very materially, giving an initial voltage of from 1.7 to 1.9 volts. It is also claimed that the life of the battery is prolonged one-third to one-half, comparative tests having been made with sal-ammoniac.

Another very important advantage gained is the fact that the zinc remains free and clear of insoluble salts of zinc and presents a clean surface until completely exhausted. Crystallization and the difficulties due to creeping salts are practically disposed of, as the salt does not crystallize or form any insoluble matter, and the carbons therefore continue to present the same appearance during the life of the battery.

This feature of the salt, it is said, adds greatly to its commercial value, as the amount of time and labor thrown away in cleaning zincs and washing and soaking carbons is a great consideration where large numbers of cells are in operation. Federal salt can be used wherever open circuit work is required; however, it will give better results in the simple carbon-zinc cell than in one in which peroxide of manganese is used for the depolarizer.

The depolarizing effect in the Federal salt solution is due to a soluble oxidizing agent of great power, which destroys the hydrogen gas as soon as it is formed. Therefore it is simpler to do away with the peroxide of manganese and use the more efficient carbon-zinc type with the new compound as an electrolyte.

The same company is also introducing a compound for Fuller cells, which it believes will be recognized as superior to the dangerous acids and poisonous salts such as bichromate. The salts for both types and sizes of cell are put up in packages containing a full charge, dispensing with the handling and carrying of liquid acids, which is so objectionable. In addition to this the porous cup now necessary in the Fuller cell is done away with, thereby reducing the internal resistance considerably and lessening the cost of the cell.

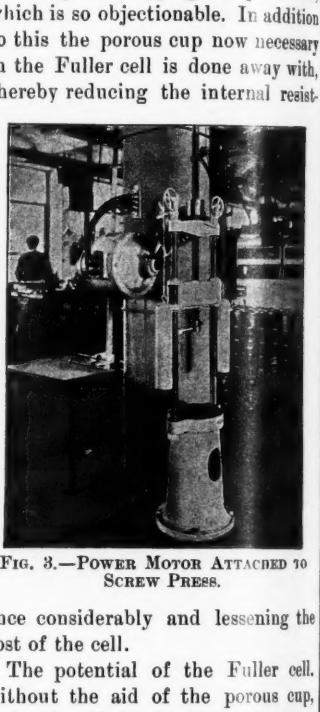


FIG. 3.—POWER MOTOR ATTACHED TO SCREW PRESS.

The potential of the Fuller cell, without the aid of the porous cup, and using Federal salt, is about 1.9 volts. This is slightly lower than the same cell gives with the bichromate solution.

However, the life of the battery is one-third longer, this fact having been demonstrated on a practical scale in two of the largest telephone exchanges in the country. It is said that the solution of the new salt is liquid at very low temperatures, and that the danger of freezing is small. Comparative tests of new cells of Le Clanché battery and cells of the carbon-zinc type after 7 months use with the new salt show some interesting figures. After 5 minutes the initial potential of 4.7 volts on the Le Clanché cells dropped to 2.9 volts, while under the same test, 5 minutes short-circuit through a telephone transmitter—the intial E. M. F. of 4.3 volts of the new type of cells dropped only to 3 9 volts. At the same time the internal resistance of the cells diminished, maintaining an almost steady flow of current.

Messrs. A. M. Young and Walton Ferguson are interested in the Federal Battery Company, of which Mr. Frederick U. Overbury is general manager.

Some British Opinions of the Paris Exposition.

In an editorial article in the issue of September 13, 1899, the ELECTRICAL REVIEW took the position that American manufacturers would do well to consider the political and judicial situation in France before going to any great expense to prepare exhibits for the exposition next year. It was argued that a country in the hands of a military cabal and in which justice is a farce and where foreigners are hated, is an unsafe place for valuable exhibits; also that there is no certainty that there will be any exposition. The British press simultaneously expressed almost the same opinions. For example, the September 15 issue of the (London) *Electrical Engineer*, under the title "Science and Politics," thus discusses the matter:

"It is said that science knows no country. That is so. Hence we can not go the length of some of our daily contemporaries in their condemnation of everything French. There is a heavy shadow upon that land, for the face of Justice is hidden, but we ought not to wound further the members of that minority who have so nobly striven in the path of duty and honor. Their sorrow is the sorrow of all who love truth. Our sympathies, then, must be with that small but noble band who are trying to work out the salvation of their country, to overrule fanaticism, and to preach the gospel of peace and goodwill. . . When, however, we deal with the question of the exhibition next year, that is another matter, and we agree entirely with those who think that civilized nations ought to take no part in it. The exhibition is practically a money speculation, from which the Paris of no morals and no conscience hopes to realize cash in large quantities from the visitors. Is civilization to stand by and see a man slowly tortured to death, and hold out no saving hand? If it does, it shares the obloquy. Are those men who write to the papers and say, "We are commercial men, and must think of the shareholders, must first consider our pockets," one whit better than the judges whose hearts failed them in the presence of their perjured superiors? We say not, and class them with the rabble that is doing its best to murder a man whom all the world knows to be innocent. For our part, unless justice is done and done at once, we shall refrain from reporting the exhibition, and, instead, will pay particular attention to the description of the work of those firms whose conscience does not permit them to condone an act of medieval barbarism. In face of the various letters in the dailies anent the exhibition, we are bound once more to emphasize the fact that the principle underlying its initiation is neither to benefit commerce generally nor to elucidate scientific questions, but simply to attract a pleasure-loving public, and make all the money possible out of the visitors."

Another British contemporary, *Lightning*, on September 14, said: "For the suggestion that foreign manufacturers should abstain from sending exhibits to Paris next year, there is something more to be said. Any national refusal to take part in the Exhibition is to be deprecated, but individual firms may well hesitate to send valuable property to a city where the populace is so disorderly and excitable, and the executive so weak. The farce of Fort Chabrol, a thing too ridiculous to be possible save in the one country where it used to be said that ridicule kills, is of itself sufficient justification for caution. But it would not be to the credit of the British Association that it should be said that its members were afraid to visit Boulogne."

The *Practical Engineer* of September 15 says: "As far as the British section is concerned, the Paris Exhibition seems to stand in a very precarious position, and the points which affect us will, in as great a measure, influence other foreign participations. In the first place, our manufacturers never got in any way enthusiastic over the project, owing to the small space allotted to Britain, to the continued lukewarmness of the British Commissioners, and to the large measure of industrial activity precluding attention to an exhibition abroad whose chief feature will be social rather than business. There comes now the great uncertainty of the political situation. The state of disorder has prevailed for so long, that prospective exhibitors are only awakening now to the fact that it will in all likelihood be necessary not only to insure as heretofore all articles against fire, but also against war risks, a state of affairs quite unique in the history of exhibitions.

The editor of the London journal, *Electricity*, says, in its issue of September 15:

"I trust most earnestly that the movement for boycotting the Paris Exhibition, which has been effectively begun by several large manufacturing firms in this country, including the General Electric Company, will be vigorously taken up. Sentiment has not, as a rule, much place in business matters, but the Dreyfus decisions in the French courts of justice, endorsed with practical unanimity by the whole French nation, constitute an outrage upon civilization which should not be ignored, which strikes, indeed, at the root of all honest dealing in the ordinary concerns of life. It is impossible, as one writer on the subject has already said, to have any confidence in the awards of judges who endorse and approve such scandals as the late proceedings at Rennes; and many years will have to elapse before confidence in French impartiality and French justice is restored."

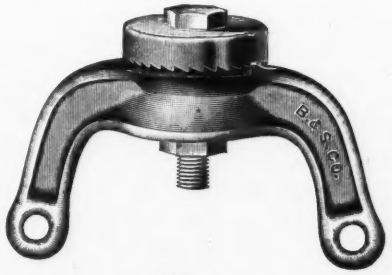


FIG. 1.

FIG. 2.

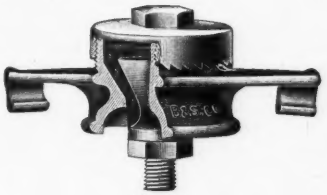


FIG. 3.

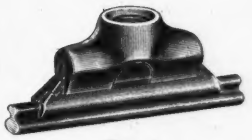


FIG. 4.

FIG. 5.

MODERN MATERIAL FOR OVERHEAD STREET RAILWAY CONSTRUCTION.

Modern Material for Overhead Street Railway Construction.

In the illustrations herewith are shown some types of modern material for overhead street railway construction manufactured by the Billings & Spencer Company, of Hartford, Ct. Fig. 1 shows a double-curve hanger, Fig. 2 a single-curve hanger, Fig. 3 a straight-line hanger, all of which are made of bronze, galvanized malleable iron or colophite insulation; Fig. 4 illustrates a trolley wire clip for round or figure 8 wire, and Fig. 5 shows a new type of insulating stud.

The hangers are all provided with a ratchet and pawl arrangement to insure against the liability of the caps coming loose. The insulating stud shown in Fig. 5 is used in all the hangers illustrated. The manufacturers state that in a recent test, made without their knowledge, a straight-line hanger (Fig. 3) stood a stress of 17,000 pounds without breaking. At a stress of 17,830 pounds the thread on the insulating stud broke, but the insulation remained intact. Engineers have stated to the manufacturers that the conical form of bolt-head is a great advantage, as all the material is practically in compression. The ratchet and pawl arrangement would seem to be an important improvement for keeping the caps in place.

ELECTRIC LIGHT FLASHES.

The English, Ind., Electric Light & Manufacturing Company has failed, with liabilities between $150,000 and $200,000 and assets unstated.

More than 1,000 new arc lights, in portions of Chicago which have before been lighted by gas and gasoline lamps, will be turned on by October 1.

The Stevens Point, Wis., Lighting Company has been reorganized, all its old indebtedness discharged, and contracts let for the rebuilding of the plant and extensions of the service that will cost $75,000.

The New York and Staten Island Electric Lighting Company threatens to cut off all the lights on Staten Island on October 5, unless the city of New York, by that time, has made some kind of a contract that it shall be paid for its services.

Dispatches from Columbia, S. C., announce that the syndicate of Baltimoreans which recently acquired the Columbia Street Railway, Light and Power Company is perfecting plans to absorb the Columbia Canal and Water Power plant, which is owned by the Columbia Water Power Company.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

MIFFLINTOWN, PA.—The Tuscarora Telephone Company, of Mifflintown, has been chartered at the State Department in Harrisburg, with a capital stock of $40,000. The company will erect lines through Adams, Bedford, Blair, Centre, Clinton, Cumberland, Dauphin, Franklin, Fulton, Juniata, Lycoming, Mifflin, Northumberland, Perry, Schuylkill, Snyder, Union and York counties.

BETHEL, ME.—A telephone line connecting this place with Rumford Falls is being put in. The line will run along the Androscoggin River, and poles are already set for several miles. There will be two offices, one at Newry Corner, the other at Hanover.

PORT ROYAL, TENN.—A telephone line running from Clarksville to Holmansville, via Rudolphtown and Port Royal, is being built and will be in operation by the middle of October. Mr. T. M. Williams, a prominent farmer of Holmansville, is interested.

ROME, N. Y.—The Constableville and West Leyden Telephone Company has completed connections with this city and Lee Line, Lee Center, Stokes, Delta, West Branch, Ava and West Leyden. Among other places to be connected on the line are Constableville, Boonville, Turin, Lowville, Mohawk Hill and other northern towns. The station here is at White's hotel.

NEW YORK, N. Y.—The New Telephone Incorporation, with a capital of $10,000, has been incorporated with the Secretary of State. Besides the general city route, points are to be connected at Yonkers, Poughkeepsie, Hudson, Troy, Albany, Saratoga, Plattsburg, Ogdensburg, Watertown, Schenectady, Little Falls, Utica, Syracuse, Oswego, Rochester, Buffalo, Dunkirk, Hornellsville, Middletown, Newburg, Nyack, and all intermediate and adjacent cities, town, villages and other places in the state. The directors are William G. Conklin, Edward Ashforth, S. Melville Knowles, George W. Romaine, D. A. Reynolds, William P. Catlin and Charles F. Abell, of New York city.

BOWLING GREEN, OHIO—A deal has been consummated here by which the People's Telephone line passes into the hands of a new company. The new concern is organized under the laws of Ohio, as the Bowling Green Telephone Company. The directors of the company are Capt. L. Black, J. G. Hickox, F. A. Baldwin, Bowling Green; Kenneth V. Murray, Cleveland, and Fred J. Bollmyer, Wauseon. The directors met at the Exchange Bank last Friday, and organized by electing Capt. Black, president, and J. G. Hickox, secretary and treasurer. The company is capitalized at $15,000, and $1,600 will be expended in local improvements.

PARIS, TEX.—The telephone line from Checota to Arthur City has been completed, and residents of Grant, I. T., are making an effort to have it extended to that place.

WOODLAND, CAL. — The private telephone line between Arbuckle and Cranmore will be ready for business about October 1.

COOPER, TEX.—The local telephone exchange is about completed, and when finished there will be something over 100 'phones in operation. The long-distance telephone from Commerce to this place and Paris will be completed by the 20th.

PITTSBURGH, PA.—The Federal Telephone Company has been incorporated; capital, $10,000; directors, Fred Deland, Joseph C. Forse, Joseph McClure, Pittsburgh.

New Electric Railways.

KANSAS CITY, MO.—The project to build an electric line from Kansas City to Topeka, which has been pending for the last two years, begins to take definite form. New men have taken hold of it, and a charter has been granted them by the State Board of Charters under the name of the Kansas City, Lawrence & Topeka Railway Company. The company is capitalized at $2,000,000, divided into 20,000 shares.

TIFFIN, OHIO—A franchise has been granted to Theodore Wentz to operate the Findlay, Fostoria & Toledo Electric Railway on certain streets and roads near Fostoria.

BUCYRUS, OHIO—The connection of Tiffin and Upper Sandusky by an electric line is being considered.

MENOMINEE, MICH.—The Ann Arbor Railroad has begun the construction of a belt line around the twin cities.

COVINGTON, KY.—The Covington, Cincinnati & Erlanger Street Railway Company has been incorporated. The capital stock is $250,000.

CAMBRIDGE SPRINGS, PENN.—The Cambridge Springs Street Railway Company has been incorporated; capital, $30,000; incorporators, W. D. Rider, W. D. Rider, Jr., O. G. Benson, Cambridge Springs; F. P. Ray, Meadville; E. W. Nichols, Franklin.

HARRISBURG, PA.—A charter has been issued to the Wilkinsburg, Frankstown Avenue & Verona Street Railway Company, of Allegheny County, with a capital of $54,000. The line runs from the northern line of Oakmount Borough to Verona and thence along Frankstown road to Wood street, Pittsburgh. John Guffey is president and the directors are A. L. Schultz, J. C. Fisher, M. C. Dwyer, of Pittsburgh, and J. Frank Peffer, of Tarentum.

OMAHA, NEB.—A new motor line between Omaha and Council Bluffs, costing $500,000, is to be built. A syndicate of St. Louis capitalists is to build the line. The new company will be known as the Omaha & Council Bluffs Suburban Railway Company, and it will operate under the franchise granted the Lake Manawa & East Omaha Construction Company at a special election held December 1, 1897. The company will also assume control of the pleasure resort at Lake Manawa. The steam railway between the city and the lake will be transformed into an electric line, and during the Summer months cars will be run direct from Omaha to the lake. The original plan of the Lake Manawa & East Omaha Construction Company to build a line to Fairmount Park will also be carried out by the new company. The new line is to enter Omaha over the Terminal Company's bridge.

VENICE, ILL.—The Granite City, Venice & East St. Louis Railway has been incorporated; capital, $125,000; operating electric street railways; incorporators, E. J. Spencer, Fred E. Allen, J. S. Tritle.

TORONTO, ONT.—The York township council at a recent meeting considered the Avenue road and Mount Pleasant extension of the Toronto Street Railway.

BETHLEHEM, PA.—A charter has been granted to the County Central Street Railway Company, of this city, to erect a line five miles long in Northampton County. The line will be operated by electricity. The capital stock will be $30,000, and the directors are, Joseph J. McKee, F. W. Leinbach, Alvin Hill, Truman M. Dodson, C. O. Walle, George H. Wolle, of Bethlehem; G. A. Schreebeli, of Nazareth; Andrew S. Keck, of Allentown; C. R. Horn, Catasauqua.

New Incorporations.

DENVER, COLO. — The Mariposa Consolidated Gold Mining and Electrical Power Company has been incorporated; capital, $500,000. Incorporators, E. C. Hahn, G. G. Ligluri, J. C. Doyle, J. E. Budd, J. W. McCarthy, all of Denver.

EAST ORANGE, N. J.—The General Electro-Chemical Company has been incorporated, with a capital stock of $100,000. Incorporators, Edwin S. Webster and W. Cameron Forbes, of Boston, and Charles S. Bradley and Charles B. Jacobs, of New York.

NEW YORK, N. Y.—The Electric Boat Company has been incorporated; capital, $50,000. Incorporators, Isaac L. Rice, Hoffman Atkinson, Robert McA. Lloyd, E. B. Frost, John P. Holland, William Dulles, Jr., J. C. Chamberlain, all of New York city.

LOS ANGELES, CAL.—The Los Angeles Incandescent Vapor Light Company has been incorporated. The capital stock is $100,000. The promoters and directors of the new corporation are J. F. Turner, M. J. Blaisdell, E. Hill, C. H. DeVoll and C. H. Herrington, who control the whole stock.

OMAHA, NEB.—The Metropolitan Plumbing and Chandelier Company has been incorporated to do a general plumbing, gas, electric and steam fitting business; capital, $10,000. Incorporators, A. B. Jaquith, J. Morrisey, C. F. Hotchkiss, all of Omaha.

YONKERS, N. Y.—The Ball Electric Company has been incorporated to deal in apparatus in connection with generation and distribution of electricity. Capital, $300,000. Directors: Abram Sebring and Eldoras M. Roberts, of Brooklyn; Daniel Reimsen, of Dobbs Ferry; Willbur F. Randall, of New York city, and Chas. D. Silleck, of Ridgewood, N. J.

JERSEY CITY, N. J.—The J. Roberts Patents Company, office, No. 259 Washington street, has been incorporated to manufacture electric arc lamps. Capital, $20,000. Incorporators: Joseph Roberts, August Dege, Robert Carey, all of Jersey City.

PAWTUCKET, R. I.—The Phillips Insulated Wire Company has been incorporated to manufacture and deal in electrical wires, insulated conductors and machinery. Capital, $250,000. Incorporators: H. O. Phillips, E. B. Phillips, both of Providence.

Electric Light and Power.

CUERO, TEX.—This city has under advisement the erection of an electric light plant in conjunction with its waterworks. The city would like to have estimates for the complete erection of a plant. There will be about 12 miles of wiring, 100 street lights of 50 candle-power, and 1,000 private lights. Such communications can be addressed to the Mayor, J. C. Woodward.

BEVERLY, MASS. — The Jubilee Yacht Club will install its own electric plant for the purpose of lighting the clubhouse, and will have the current available at all times, both day and night.

LE ROY, N. Y.—Le Roy Gas and Electric Company has been incorporated; capital, $35,000; incorporators, S. D. Purdy, of Buffalo; B. Ward, of Le Roy; C. F. Pond, of Rochester.

LAKEWOOD, N. Y.—The plant of the Lakewood Water Company, including its sewerage system and the Lakewood Electric Light Company, has been purchased by a new company, which has been incorporated under the name of the Lakewood Water, Light and Power Company. The new company has been capitalized at $150,000, of which $140,000 has been paid in. Its officers are, president, Frederick R. Drake, of Easton, Penn.; secretary and treasurer, Carroll Ph. Bassett, of Summit; directors, Charles H. Kimball, F. P. Kimball, D. D. Davis, A. D. Davis, William J. Harrison, of Lakewood; Charles H. Payson, of Portland, Me.; Frederick Green and Carrol Ph. Bassett, of Summit, and Frederick R. Drake.

FREDERICKSBURG, PA.—An electric light plant will be built at this place by Elias Gerhart.

Kindred.... ...Interests

The General Electric Automobile Company, Bourse Building, Philadelphia, has issued a booklet illustrating the various types of electromobiles it manufactures.

The Central Electric Company, Chicago, state that they are prepared to supply electric heating and cooking devices and already are receiving orders and inquiries for these goods.

The Jantz & Leist Electric Company, of Cincinnati, has a well equipped plant for manufacturing multipolar dynamos and motors. The company also makes a specialty of designing and building motors to suit any kind of machinery.

The Ericsson Telephone Company, of 296 Broadway, New York city, is issuing leaflets containing telephone information which are called "The Ericsson Series." The leaflet will be issued at regular intervals in convenient form for reference and use.

Bullock Electric Manufacturing Company, Cincinnati, Ohio, are sending out an attractive circular, No. 0728, illustrating and describing the Bullock electric power system for operating newspaper presses. This company has made a special study of this field with fine success.

The Emerson Electric Manufacturing Company, of St. Louis, has sent out an illustrated bulletin describing its extensive line of marble tablet boards and switch cabinets. The company has also issued a circular on high-grade knife switches of interest to the trade. Both publications may be had free on application.

Over five thousand letter-carriers visited Scranton, Pa., on Labor Day and took part in a parade which preceded the business session of the tenth annual convention of the National Association of Letter-Carriers. In honor of the occasion the business houses of the city were handsomely decorated and electrical devices were freely used. The International Correspondence Schools had a large monogram, "I. C. S.," with letters composed of red, white and blue incandescent lamps in front of their building, making a very fine display. This institution has over a hundred thousand students, and as its mail is handled by carriers in all parts of the country, they were much interested in inspecting the home office at Scranton.

The Michigan Electric Company, of Detroit, Mich., has been awarded the contract for furnishing and installing for John A. van der Poel, of Brookline, Mass., a complete electric plant for a yacht, now building in Detroit, which will include a gasoline engine, Western Electric generator, switchboard, electric searchlight, storage battery and complete wiring, fixtures, etc., as well as an electric revolution indicator and engineer's signal system, making altogether one of the most complete possible electric plants for a yacht. This company is also in receipt of inquiries from New York city, Cleveland, O., Toledo, O., Shreveport, La., Syracuse, N. Y., and Dallas, Texas, for prices on electric signs which it makes a specialty of designing and manufacturing, those it has already manufactured and installed having attracted most favorable comment.

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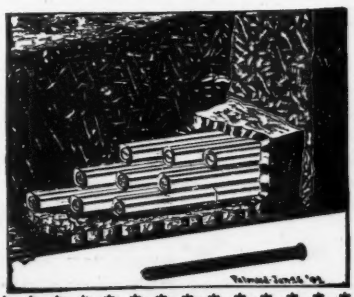

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[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED SEPTEMBER 19, 1899.

633,478 Combined electric motor and pump-head; R. J. Northam, Los Angeles, Cal.

633,494 Electrical railway support; J. Shoecraft, Topeka, Kas.

633,516 Centrifugal electric switch; R. L. Hunter, Minneapolis, Minn.

633,544 Electrolytic apparatus for precipitating metals; H. S. Badger, Denver, Colo.

633,547 Telephone system; W. M. Davis, Chicago, Ill.

ISSUED SEPTEMBER 26, 1899.

633,558 Electric railway; R. W. Barkley, New York, N. Y.—Consists of a current-collector, a pivoted carrier therefor, and a continuous unbroken conductor, leading from the collector along the carrier and leaving the same in line with the axis of motion thereof.

633,565 Device for lighting lamps by electricity; H. M. Brigham, New York.

633,567 Meter-registering device; J. M. Byron, Boston, Mass.

633,576 Casing for and mounting of electrical fuses or cutouts; L. W. Downes, Providence, R. I.

633,577 Casing for and mounting of electrical fuses or cutouts; L. W. Downes, Providence, R. I.—A plug having a projecting screw contact at one end, a contact at its other end, and a fuse connected between said contacts, a socket having an interiorly-screw-threaded sleeve-contact in its closed end adapted to be engaged by the screw-contact on the plug, and a spring-contact at its open end adapted to bear against contact-plate on the plug and to form and maintain such contact so long as the screw and sleeve contacts are in engagement.

633,586 Printing-telegraph system; C. L. Healy, Newark, N. J.

633,594 Electric traction of railway trains; O. H. E. Kaselowsky, Berlin, Germany.

633,623 Street-indicating device for street-cars; S. Squire, Westfield, Mass.

633,641 Dynamo-electric machine; C. A. Eck, Newark, N. J.—A brush-holder having two superposed compartments extending parallel to each other and a fastening-piece extending at an angle to the said compartments.

633,702 Electrical measuring and indicating apparatus; C. F. Rodde, Gross Lichterfelde, Germany.

(Continued.)

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NOTICE IS HEREBY given that the Annual Meeting of Stockholders of the Electrical Review Publishing Company, for the election of a Board of Directors for the ensuing year and the transaction of such other business as may properly come before the meeting, will be held at the offices of the company, No 41 Park Row, in the city of New York, on the 14th day of October, 1899. The polls will be opened at three o'clock and closed at four o'clock P. M.

Dated September 25, 1899.

STEPHEN L. COLES, Secretary.

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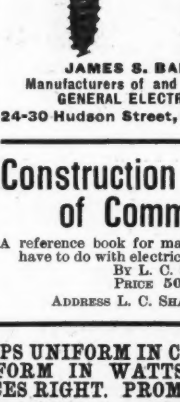

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